SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

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FRIDAY, DECEMBER 19, 1902.

CONTENTS:

Policy of the Smithsonian Institution..... 961
The Academy of Sciences: PROFESSOR J. MCKEEN CATTELL 965
The Annual Address of the President of the Royal Society 974
The Carnegie Institution..... 978
Scientific Books:—
Spiller on the Mind of Man: PROFESSOR JOSEPH JASTROW. *Archiv für Protistenkunde:* G. N. C..... 980
Scientific Journals and Articles..... 982
Societies and Academies:—
The American Association for the Advancement of Science. The Geological Society of Washington: ALFRED H. BROOKS. *The Biological Society of Washington:* F. A. LUCAS. *The Research Club of the University of Michigan:* FREDERICK C. NEWCOMBE 983
Discussion and Correspondence:—
The Carnegie Institution: PROFESSOR S. E. MEZES, CHARLES H. STERNBERG, ROSWELL H. JOHNSON, PROFESSOR W. A. NOYES. *The Onondaga Lake Squids:* DR. JOHN M. CLARKE. *The Fossil Tree Bridge in the Arizona Petrified Forest:* PROFESSOR HENRY F. OSBORN..... 987
Shorter Articles:—
Mendel's Principles of Heredity and the Maturation of the Germ-cells: PROFESSOR EDMUND B. WILSON..... 991
The Enlargement of the Naples Station: PROFESSOR T. H. MORGAN..... 993
Notes on Inorganic Chemistry:—
The Telluric Distribution of the Elements; The Nature of Alloys; The Training of Technical Chemists in England: J. L. H.. 994
Current Notes on Physiography:—
Northeast Labrador; Physical Geography of New York; New Map of Switzerland: PROFESSOR W. M. DAVIS..... 995
Scientific Notes and News..... 996
University and Educational News..... 1000

POLICY OF THE SMITHSONIAN INSTITUTION.

IN our issue of November 21, we commented on certain recent proceedings of the Smithsonian Institution having an important bearing on the question of its policy. We now return to the subject, in order to review the question at issue from a more comprehensive standpoint.

The Smithsonian Institution should be regarded as a sacred trust confided to our government by a foreigner for a specific purpose. We are bound to administer this trust in accordance with the expressed will of the donor, who defined it as 'an institution for the increase and diffusion of knowledge among men.' A point of fundamental importance which should not be overlooked is that the bequest was not made to second the efforts of our government to increase and diffuse knowledge, but to found an institution which should itself do so. Questions to be considered are: What are the funds available for these purposes and how are they used to increase and diffuse knowledge? We summarize from the last annual report the following

statement of the principal and income of the fund:

	Principal.	Income.
Smithsonian fund proper....	$650,000	$39,000
Miscellaneous additions.....	62,000	3,720
Hodgkins gift	200,000	12,000
Hodgkins special fund.....	42,500	1,680
Total	$954,500	$56,400

Of the Hodgkins gift the income of $100,000 is to be especially devoted to increasing and diffusing knowledge of the atmosphere and related subjects connected therewith. Leaving this out of consideration, there is still an annual income of $50,400 available for the general purposes of the establishment.

Passing to the question of the expenditure of this amount, the first item to demand our attention is that of international exchanges. The number of packages handled by this bureau during the past year was 121,060. What does this bureau cost the institution annually? If we interpret aright the statements in the report, the answer will be, nothing at all. A clear profit seems to be made from it through the fact that the government appropriation for the bureau, together with the payments received from freight, more than balance the cost of the service. The account seems to admit of being stated in the following form, using only round numbers: The institution expends $5,758.24 in addition to the government appropriation of $24,000. But the repayments for freight, etc., were $10,240.80, leaving a clear profit of $4,482.56. It follows that the bureau in question, instead of being a draft upon the income of the Smithsonian fund, is an important source of profit to it. Adding this profit to the regular income, we have a total of more than $58,000 available for other purposes.

How is this expended? On this point we have few details, only general statements, which tell us very little. Rearranging the statements in our own way, they may be summarized as follows: Somewhat more than $29,000, or fully one half of the whole amount, is reported to have been paid for salaries and services. What were the services rendered in return, and what is the outcome of the expenditure? These are questions to which no definite answer is made. Only two officers are given in the annual report, and one of these draws a salary from the government appropriation for the National Museum. The names of individuals are, of course, of no importance, but the offices which they fill and the services which they render are matters of public interest and should be made known with the same fullness that they are in the case of a government bureau. We can only guess that the amounts constitute the salaries of the Secretary and his immediate assistants, and of persons employed in various miscellaneous functions in connection with the National Museum and other government establishments under the control of the institution.

Under another general head will come about $12,665 for what we may call general administrative expenses, classified in the report as building, furniture, incidentals, books, periodicals, etc.

The third class includes publications and researches. Here again the information is

only of the vaguest kind. The amount spent for researches was $4,686, of which $2,151 was for salaries and personal services, but no specific statement is made of the amount expended on any particular research, nor, in fact, are any researches reported except those made at the expense of the Hodgkins fund. As the available income for this purpose is considerably greater than the whole amount reported as spent in researches, we are left to infer that no researches are made at the expense of the Smithsonian fund proper. Nearly $2,000 was spent for reports, what reports is not stated. There is an additional item of $4,473.51 expended from the Hodgkins fund, but with what object is not stated. It is not necessary to enumerate the other items as given, because they fail to give us any information of interest. Our own reclassification of the reported income and expenditures is as follows:

INCOME.

Interest on funds in U. S. Treasury..	$54,720.00
Interest on West Shore bonds.....	1,680.00
Profits on international exchanges...	4,482,56
Cash from sales of publications.....	188.59
Total net income.....	$61,071.15

EXPENDITURES.

Salaries and services.....	$29,566.06
Other expenses of administration.....	12,665.56
Publications, reports, researches, etc..	6,621.83
Expended from Hodgkins' fund.....	4,473.51
Surplus for the year.....	7,744.19
Total	$61,071.15

The surplus of $7,744.19 is the same that follows from the report as the increase in cash on hand. The main points in which we have rearranged the statements are the deduction of the expenditure for exchanges from the amount received for freight and the classification by themselves of all payments for salaries and services.

In the large amount, nearly four fifths of the whole expenditure, for salaries and administrative expenses, and the smallness of the fraction devoted to the increase or diffusion of knowledge in any definable way we are brought face to face with two policies on which views have been divided since the foundation of the institution. One of these was distinctly the policy of Professor Henry, enforced by him on every opportunity—the devotion of the institution to the original purpose desired by Smithson, of increasing and diffusing knowledge. The other policy was the more popular one of making the institution an auxiliary to government efforts in the same direction, by charging it with the care of the government collections and improving science and art generally at the national capital. How strong the present tendency in the latter direction may be seen in the preceding analysis. Apart from this it does not look well to see one half the entire Smithsonian income paid to unknown persons for unknown services.

The expenditure of so large a sum as the present income of the Smithsonian Institution in increasing and diffusing knowledge is a noble work, and its efficient prosecution demands the entire time and energy of the head of the institution. No more worthy expenditure of that time and

energy can be found—none which would place the institution and its head higher in the estimation of the world of learning—than its exclusive devotion to this object. Without any disrespect to the functions of the general administrator of the National Museum, the Zoological Park and other government establishments under the direction of the Smithsonian Institution, we cannot but feel that the functions we have described as appropriate are of a higher order, especially when performed by men of the eminent standing in the scientific world which has been held by the three secretaries of the institution.

It also seems to us much to be regretted if, as we interpret the statement of the report, the larger part of the income from the Smithsonian fund is employed in filling deficiencies in the government appropriations for the care and exhibition of its collections. The Smithsonian building is not necessary for the proper purposes of the institution. It is, indeed, almost entirely occupied by collections which are the property of the United States. If, as we suppose, some $40,000 of the income is expended in operations connected with and going on in this building and in the National Museum, then the divergence of the policy from that defined by the first secretary of the institution is marked indeed.

We do not overlook the claim that all the objects of expenditure may be in the line of diffusing knowledge. But, if we admit this claim, we must also grant that the most powerful agency employed by our government for this purpose is the Government Printing Office. It is difficult to see why the Smithsonian income might not be as legitimately expended in the support of this office as in the housing, care and exhibition of the government collections.

If our view, based on these considerations, is correct, two radical changes should be made in the policy in question. The separation advocated by Professor Henry between the Smithsonian Institution and bureaus of the government placed under its control, should be carried out. Whatever reasons may have existed in former times for this combination have now ceased to be operative. We have a Department of Agriculture to which most of the work in question appropriately belongs, against the administration of which not a shadow of suspicion is felt. The government should make all the appropriations necessary for the care, preservation and exhibition of its collections, without putting any part of this expense on the bequest of a foreigner. The time of the head of the institution should not be taken up with administrative details, but should be devoted to the application of its large income to the worthy purpose of increasing and diffusing knowledge. We are sure that, by taking this step, the standing of the institution and of its head in the eyes of the scientific public would be greatly enhanced.

The other measure is complete publicity of the operations and expenditures of the institution. Instead of the general statements of expenditure now in the reports, we should have a specific statement of the

purpose of each expenditure, and of the results reached by it.

These suggestions involve no reflection upon the eminent citizens who form the board of regents of the institution. We are sure that none will grasp the situation more readily than they when once it is brought to their attention. We feel that they are abundantly able to judge of the good policy of expending almost the entire income of the fund entrusted to them in eking out the appropriations made by congress for the National Museum and other local objects. If the claim is made that the Smithsonian Institution is in touch with the science of the world by its system of international exchanges, and with the people of the country through its annual reports, they are abundantly able to see that the prosecution of the first is a source of gain to the institution, and that its annual reports, being printed by Congress, cost the institution far less than the profit upon exchanges, so that the entire income is still available for other objects. We believe that the more carefully the able members of the board of regents consider this subject, in the light of past experiences and present conditions, the more fully they will appreciate the force of the considerations we have suggested.

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*THE ACADEMY OF SCIENCES.**

TWENTY-THREE centuries ago, when the first and fairest flowers of civilization were in blossom, Plato and his friends met together in an Athenian garden to talk of the things that appeared to them to be beautiful, good and true. The garden was called 'The Academy,' and the word has ever since maintained the high traditions of its origin, uniting the ideas of friendly social intercourse and the search for truth. The philosophy of Plato was passed on to his disciples, so that we read of fourth and fifth academies; it was transplanted to Rome, where Cicero named his country house 'The Academy,' and to Alexandria, where mystical neo-platonism long resisted the dogmatic rationalism of the church.

As part of the Italian renaissance, when civilization was once more young, vigorous and beautiful, as in the Greek period, the word 'academy' was revived and used to name a society of scholars. Cosimo dei Medici, the Elder, established at Florence in the fifteenth century a *Platonic Academy,* and academies of letters by the hundred flourished in Italy during the sixteenth century. In 1560 there was established at Naples by the versatile Giambattista della Porta the first academy of sciences—*Academia Secretorum Naturæ*—to which only those were admitted who had contributed to the advancement of science or medicine. The academy at Naples was suppressed on the accusation that it practised the black arts; but soon afterwards there was established at Rome, with Galileo as one of its members, the *Accademia dei Lincei,* which was later revived and is now one of the great national academies.

The mere word 'academy' is of course unimportant; societies of scholars are not always called academies, nor are all academies societies of scholars. The beginnings of associations for the advancement of knowledge are to be found in savage tribes, developing with the state of civilization, usually in the form of guilds of priests, until we reach the Greek period, whence we date our philosophy and our science. The culture of Greece was carried to Alexandria, where Ptolemy Soter, supposed to be the son of Alexander the Great, estab-

* Address of the president of the New York Academy of Sciences, read on December 15, 1902.

lished the beginning of the μουσεῖον, based on the four corner-stones of science and culture, the university, the academy, the library and the museum; and this institution maintained its prestige for centuries. We have here an association of scholars that surpasses anything to be found in Greece or Rome, and one indeed that approaches an ideal more nearly than any existing institution. Supported by the government, we find men of science living together and working together, a system of lectures, a library of 600,000 titles and the like. To these conditions we may attribute the work of Aristarchus, Eratosthenes, Hipparchus, Ptolemy, Archimedes, Euclid, Herophilus and others, who in many ways established the principles of science. Similar if less important centers of learning arose in Bagdad, Damascus and elsewhere; and there was a series of Arabian astronomers, physicians and mathematicians, who never permitted the torch of learning to become extinct, until it was merged in the dawning light of modern science.

The records of Roman history are chiefly of wars and politics; but its institutions still dominate the world. The names of Pliny, Galen and Lucretius prove that science was cultivated. It is said that there were twenty-eight public libraries in Rome in the fourth century; and the schools of the Roman Empire never became extinct. Rome was the center whence first empire and then the church spread civilization throughout Europe. The removal of the seat of empire to Byzantium, the ever recurring invasions of the barbarians from the north, and the tenets of the christian church are supposed to have extinguished learning and culture; and the period from the decline of the Roman empire to the revival of learning in Italy is called the dark ages. But perhaps these centuries are only dark in so far as they are obscured from our sight. It may seem absurd for an amateur in history to make an assertion contrary to the common views; but the scientific man, saturated with the doctrine of evolution, is loth to accept a spontaneous generation of culture at the period of the late Italian renaissance. Students of medieval history are indeed beginning to date back this period of awakening to the thirteenth or even to the eleventh century; but there appears to be much evidence for a gradual extension of civilization and culture throughout Europe from the sixth to the eleventh centuries.

It is a long way from the love passages of the Phædrus to those of the Vita Nuova, from the fawn of Praxiteles to the madonna of Giotto, from the Phrygian mysteries to the order of St. Francis. The christian church is said to have been inimical to culture and science, but to it we owe the establishment of monasteries, schools and libraries throughout Europe. It is natural that the civilizations of Athens and of Rome should have become merged in the surrounding peoples. We might as well wonder why Shakespeare did not give rise to a line of poets, as to wonder why the Athens of Pericles was not permanent. When Rome came in contact with the peoples of the north, an average resulted which was in the end an extension of civilization. The barbarians who overran Italy and sacked Rome were themselves converted to christianity, and the traditions of culture were carried beyond the Rhine and the English Channel.

Boetius, whose birth coincided with the fall of the western empire, wrote on science as well as on philosophy. From his death, in 525, education and learning were in the hands of the church. Gregory the Great, pope from 590 to 604, encouraged primary education; and monasteries, being at once schools, libraries and academies of learned men, were established everywhere under the early popes. Bede, born about

673, wrote on astronomy and medicine. At his school at Jarrow in Northumbria there were 600 monks in attendance besides strangers from a distance. Alcuin, born about the year that Bede died, went from the directorship of the school at York to establish the palace school for Charles the Great, making the court of the emperor more nearly an academy of sciences and letters than has happened elsewhere in history. Alfred the Great in the following century also cultivated letters at his court, and himself wrote on scientific as well as on literary subjects. He established schools throughout his dominion, including an academy at Oxford.

The traditions attributing the University of Paris to Charles and Oxford University to Alfred are discredited; but the schools they supported and established certainly did not become extinct, but developed into the medieval universities. The curriculum of the monastic and cathedral schools may appear narrow and trivial—the well-known seven arts, the elementary trivium—grammar, rhetoric and dialectic, and the more advanced quadrivium—music, arithmetic, geometry and astronomy; but if we compare it with the curriculum of the American or English college of a few years ago we should cast no stones. Indeed, when we try to picture the state of affairs, the invasions of the Northmen and Saracens, the wars and pillages, we can but admire the spirit that maintained schools and libraries in the monasteries, the academies of sciences and arts of the time. The Roman Church, the Holy Roman Empire, civic life and independence and finally the universities were the offspring of the so-called dark ages.

The medical school of Salerno, whose beginnings are traced to the ninth century, seems to have descended directly from the Greco-Roman period. It was secular in character, extending its privileges to Jews and women. It is of interest to scientific men that the first university should have been a school of medicine, but it must be admitted that it did not contribute considerably to the advancement of science—at Alexandria the living human body was dissected, at Salerno Latin hexameters were written on the urine—nor has its imperfectly known organization the interest for us that attaches to the universities of Bologna and Paris.

The medieval university is certainly one of the most notable institutions known to history. It appears almost incredible that 10,000 students from all parts of Europe should have frequented Bologna, when traveling was as expensive, difficult and dangerous as was the case in the thirteenth century. The guilds or trades unions of the students and teachers represent a kind of organization that is of peculiar interest to those of us who are concerned with the conduct of modern scientific societies. The present period is marked by combinations of labor and of capital, such as have not previously existed, but the guilds of the middle ages had a more complete organization, and the universities of scholars have no modern counterpart. It seems to me that we men of science suffer both in position and in character from the dependence to which we submit, and that we could with advantage learn from the *studium generale* of the middle ages.

The centers at Bologna and Paris developed almost simultaneously. Bologna was primarily a law school and Paris a theological school. The former was more strictly professional, and its students were mostly men of maturity, already holding positions in the church or state. The universities of students, representing different nationalities, obtained control and imposed their authority on the masters and on the city. The school at Paris was less professional in the sense that theology and

philosophy were the liberal studies of the age. There was at Paris from the time of Abelard a vast number of teachers gathered together from all quarters; and the formation of a university of masters was followed in the thirteenth century by the complex organization of nations and faculties.

Migrations from Bologna established universities throughout Italy, while the influence of Paris led to the universities of Oxford and Cambridge, of Prague and of the various French cities. Science in the modern sense of the word did not play an important part in the medieval university; but Roger Bacon, born in 1214, was intimately associated with Oxford and Paris, and doubtless found encouragement as well as persecution at these universities. The promise of Bacon was not fulfilled for more than two centuries; but there was a slow growth of science at the universities. Copernicus found masters at Cracow, Bologna and Padua and was himself professor at Rome. Kepler and Galileo filled chairs at universities; they bring us to the period of the organization of academies of sciences.

Francis Bacon in his *New Atlantis,* published in 1627, pictures Solomon's House as an ideal academy of sciences. I have already referred to the establishment of actual academies of sciences in Italy during the sixteenth century. They were originally clubs of scientific men or men interested in science who met together to discuss and perform experiments. Like the early universities the academies were at first independent of the state; but they subsequently received charters and appropriations of money. In the sixteenth and the first part of the seventeenth century academies of sciences were founded throughout Europe. The period was marked by extraordinary scientific progress which was greatly stimulated by the interchange of ideas made possible by the academies. The state of science was such that each member could understand and take interest in the work of all the others. Intellectual curiosity was widespread, catholic and naïve.

The Royal Society of London and the Academy of Sciences of Paris arose at about the same time and under similar circumstances. At Paris a club counting among its members, Descartes, Gassendi and Pascal met at a private house for some thirty years, until an academy of sciences was finally organized by Colbert on the model of the Académie Française established earlier under the auspices of Richelieu. The seven original members included Huyghens, who was called to Paris. They received pensions from the king and grants for instruments. The academy was reconstituted in 1699 with fifteen active members, three each in geometry, astronomy, mechanics, anatomy and chemistry. The academy of sciences became part of the Institute of France in 1795; at which time it was divided into ten sections in each of which were six members and six associates in the provinces, the sections being: (1) mathematics, (2) mechanics, (3) astronomy, (4) experimental physics, (5) chemistry, (6) natural history and mineralogy, (7) botany, (8) anatomy, (9) medicine and surgery, and (10) agriculture. An eleventh section—geography and navigation—was added in 1803 with three members. As constituted since 1833, the Institute of France contains five academies: (1) Française, (2) Inscriptions et belles-lettres, (3) Sciences, (4) Beaux-arts and (5) Sciences morales et politiques. The academy of sciences contains eight members and the other academies forty. Each receives a pension. As we all know, the intellectual life of France has been centered largely at Paris and in the academies.

The Royal Society of London resulted from a club that held meetings as early as 1645; it was finally organized in 1660 and

chartered in 1662. The membership was larger and less exclusive than in the case of the Paris Academy, and there has not been a division into sections. Under the existing statutes fifteen fellows are elected annually, and the membership numbers about 450. The fellows do not receive pensions as in the continental academies, but pay dues. The society, however, administers a government fund for research (£4,000 annually), and has in many ways cooperated with the government. There has been this year established a British Academy for the Promotion of Historical, Philosophical and Philological Studies.

The Accademia del Cimento, begun in Florence in 1657, and the Collegium Curiosum begun in Altorff, Franconia, in 1672, are types of the scientific clubs of the time. Somewhat later academies were established in various centers—the Berlin Academy in accordance with the plan of Leibnitz in 1700 and the St. Petersburg Academy by Peter the Great in 1724. The members receive salaries from the government; at St. Petersburg these are liberal, so that at one time eminent foreigners, such as Nicholas and Daniel Bernoulli, were attracted to St. Petersburg by membership. Similar academies were established in the capitals and other cities of the continent—at Stockholm, Copenhagen, Munich, Madrid and elsewhere. These imperial and royal academies were patronized by kings and princes and were part of the court life of the time.

The American Philosophical Society, modeled by Franklin on the Royal Society, had its beginnings at Philadelphia in 1743; and the American Academy of Arts and Sciences, modeled by Adams on the Paris Academy, was established at Boston in 1780. Both institutions were originally of national scope and still maintain this character to a certain extent. Academies more local in character were subsequently established in different cities, the Connecticut Academy of Arts and Sciences, founded at New Haven in 1799, being the oldest of these. Our own academy of sciences was organized in 1817 as the Lyceum of Natural History in the City of New York. The National Academy of Sciences was incorporated by congress in 1863. It was born into a world that has changed, and we may hope progressed, since the golden age of academies. The differentiation of the sciences, the dispersal of our men of science over a wide area and the general trend of democratic institutions are not favorable to the academy of the type that flourished in the seventeenth and eighteenth centuries.

The nineteenth century witnessed an extraordinary development of scientific activity throughout the world. Each science has had its great leaders who have established new fundamental principles and new lines of investigation, while the workers in the ranks are now a great army. I have had occasion during the past year to compile a biographical catalogue of the living men of science of the United States. On my preliminary list there are eight thousand who have published scientific papers, with a few exceptions, admitted because they are engaged in teaching or other scientific work of some importance. I estimate that the scientific men of the world number about 50,000, not counting those physicians, engineers and others who do not directly contribute to the advancement of science, nor those who are engaged in historical, philological and other studies, not commonly included in the natural and exact sciences.

Under these circumstances scientific organization has been compelled to adjust itself to new conditions. The two great developments have been the establishment of large national associations holding mi-

gratory meetings and of special societies for the several sciences. The German Congress of Scientific Men and Physicians was established in 1828 and the British Association for the Advancement of Science in 1831. There are similar associations in other European countries, in Australasia and in South America. Our own association was established in 1848, being a continuation of the Association of American Geologists and Naturalists, founded in 1840.

The Linnean Society for zoology and botany was founded in London in 1788 and received a royal charter in 1802. The Geological Society of London was established in 1807, and the Royal Astronomical Society in 1820. These societies were offshoots from the Royal Society, and were a necessary result of the differentiation of science and the increase in the number of men of science. At the time, however, they were supposed to weaken the Royal Society, its president Sir Joseph Banks, saying, 'All these new-fangled associations will finally dismantle the Royal Society, and not leave the old lady a rag to cover her.'

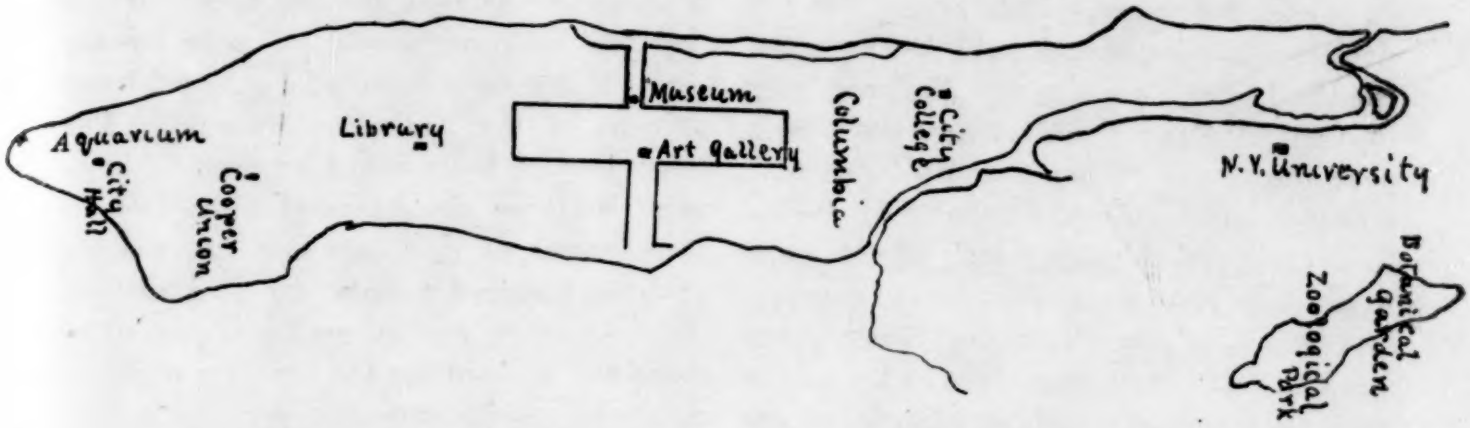
The scattering of scientific men in this country delayed the establishment of special societies. The American Association was divided into two sections in 1875 and into nine sections in 1882. The American Chemical Society was established in 1876, and we now have national societies for the principal sciences—mathematics, physics, chemistry, astronomy, geology, botany, morphology, ornithology, anatomy, physiology, bacteriology, pathology, psychology and anthropology.

New York city and members of our academy have done their share in establishing and supporting these societies. The Torrey Botanical Club, begun in 1870, was the first of the special societies. The Chemical Society was established in this city and has its headquarters here. The American Mathematical Society began as the New York Mathematical Society and still has its main center in New York, as has also the American Physical Society. The secretaries of the American Physiological Society and of the American Psychological Association are officers of our academy, and the secretary of the American Geological Society was formerly one of our most active members. The societies for civil, mining, mechanical and electrical engineering have their headquarters in New York city.

Apart from scientific societies this city has, during the past fifteen years, witnessed an unusual, perhaps unparalleled, development of its scientific and educational institutions. Columbia University has become one of the dozen great universities of the world. Its new grounds and buildings, costing $8,000,000, are but a symbol of its educational position. New York University, with its beautiful new site and buildings, has grown in equal proportion. The City College is erecting new buildings, and high schools have been established. Our libraries have been consolidated, the building for the great public library is in course of erection and numerous branch libraries have been founded. The American Museum of Natural History has more than quadrupled the value of its buildings and collections, and the Metropolitan Museum of Art has equally increased its galleries and endowment. The Botanical Garden, the Zoological Park and the Aquarium have arisen as by miracle. Hospitals, asylums and all kinds of public institutions have increased even more rapidly than the wealth of the city. In spite of Tammany Hall, in spite of reform administrations, our public, educational and scientific institutions have developed in a way that has

perhaps never been equaled hitherto or elsewhere.

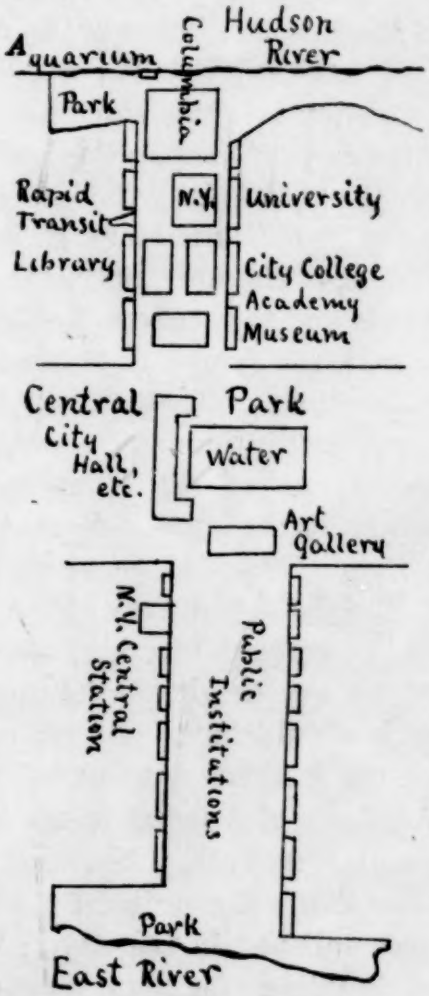
In this marvelous development there are two failures that we must all regret—one



the stationary condition of our Academy of Sciences, the other the dispersal of our institutions over such an area as to detract greatly from their usefulness. All the way from the Battery to the Bronx—some twenty miles as the trolley car goes—separated by almost impassable streets and overshadowed by tenements and apartment houses, our institutions may be found, or at least looked for. Fifteen years ago the city had a great opportunity, but no leader being at hand it was lost. The situation of some of our scientific institutions is shown on the one chart; what might have been is shown on the other.

The city could have bought the blocks from the American Museum to the North River for about $10,000,000. These remaining one half park, half the part of Central Park between the American and the Metropolitan Museums might have been used as a site for public buildings without decreasing the amount of open space, while at the same time greatly increasing its value for all the purposes of a park. The plan shows what might have been done on the west side. The wasteful duplication of libraries and the rest would have been a strengthening through cooperation for which it is not easy to find words. The site of the park and buildings would of course have been above the thoroughfares, and all the buildings would have been within five minutes ride on an underground railway.

The cross arm of Central Park should



have extended to the East River, and there should have been a park along the river,

facing Blackwell's Island and corresponding to Riverside Park. Hospitals and eleemosynary institutions could have been built on this arm of the park and facing it, while the various institutions for the defective classes would have been on the islands in the East River. The cross arm of Central Park would always have been near the center of population of the city, and if it had been made a center for its intellectual and higher social life a gain would have resulted which it would scarcely be possible to overestimate. Fifteen years ago this could have been done as far as the west side is concerned with little or no expense to the city; now it would cost $30,000,000. I should gladly expend one third the yearly income of the city for the purpose; as I am helpless and harmless I suppose there is no danger that I shall be put in the institution on Ward's Island.

The atrophied condition of the New York Academy of Sciences is as lamentable as the dispersal of our scientific institutions, but fortunately it is not so irremediable. The university, the library, the museum and the academy are, as I have already said, the four corner-stones of science and culture. They should be parts of one over-institution, and should, in my opinion, be one of the chief cares and adornments of the state, being no less essential than the police or army and the courts. As the institutions of the city can not now be brought together, we must do the best we can to give the Academy the position it should have. It is immaterial whether the institution be called the New York Academy of Sciences or the Scientific Alliance of New York. We must have an institution that will coordinate the scientific work accomplished in the city. We must have a building for our meetings and other work, and should have as part of it or adjacent to it a club house. The building should be situated near the Museum of Natural History, this being without doubt the most central position. Let us get money from millionaires if we can, but it seems to me that for the honor of the city the building should be built by the city. I see no reason why it should not be part of the American Museum. The large lecture halls could be used in common, and we should need only two or three rooms of moderate size, one seating about a hundred people, for ordinary society meetings, and others for a committee room and a room for the archives and secretariats of the different societies. The libraries and any collections there may be could with advantage be merged in those of the museum. Such rooms, if part of a wing of the museum, would cost the city perhaps $100,000. Then we should collect one or two hundred thousand dollars for a club-house to be placed across the street.

A few words remain to be said in regard to the functions of an academy of sciences under the conditions that obtain at the beginning of the twentieth century. Libraries, laboratories and museums are no longer our charge. We are primarily guilds of scientific men. The organization of science in America toward which I believe we are moving is this: We shall have a national society for each of the sciences; these societies will be affiliated and will form the American Association for the Advancement of Science, which will hold migratory meetings. Winter meetings will be held in large centers where all the societies will come together, and summer meetings will be held at points of educational and other interest when the societies will scatter somewhat. The council of the American Association composed of delegates from all the societies will be our chief deliberative and legislative body. Our national societies will consist of local sec-

tions, and these sections will unite to form an academy of sciences. The men who are in one neighborhood and engaged in the same kind of work are the natural unit. They should unite on the one hand with those in other neighborhoods to form a national society; they should join on the other hand with the men of science of the same neighborhood to form an academy of sciences. This plan of organization may appear to be almost too logical for a world that is somewhat careless of logic, but it is in part already realized. It will in my opinion result as a necessary condition from the state of affairs. Our academy has already contributed to it, and it seems to me that we should continue to do consciously what we have hitherto done rather blindly.

We have two main external functions—our meetings and our publications. For both of these the men of science interested in the same subjects are the natural group. We need not increase the number of our sections; but should allow subsections for each of the sciences, letting those who are immediately concerned meet as they find it most advantageous. These groups should maintain their own autonomy, and we should not require the members to join the academy, least of all so long as our present dues are maintained. The academy should provide convenient places for meeting, arrange for joint meetings of several groups, provide general lectures of interest to more than one group, support a club-house, give receptions and exhibitions and the like.

In regard to publications I am somewhat heterodox. Proceedings and transactions were an important function of the academy of the eighteenth century, but there is no longer any excuse for printing researches on utterly diverse subjects in one volume, because the authors happen to be members of the same academy. We might as well make up volumes according to the cranial index of the contributors. The national society for each science should directly or indirectly have charge of the publications in that science. We need in every science: (1) A series of monographs, each of which should be published as a unit, (2) a 'Centralblatt' containing abstracts of the literature with a complete bibliography, and (3) a journal for shorter articles, general discussions, critical reviews, etc. The abstracts and bibliography should be an international undertaking, each country contributing its share. What is now printed in the annals, transactions and proceedings of our academies, should be contributed to the series or journals. In the series of psychological monographs, which I am glad to say exists, should for example be printed any monographs that are prepared by our members, and if the academy has funds for publication, it should share the expense. These monographs can be parts of our proceedings and can be given to those members who are interested. Their existence will be known to every specialist throughout the world. They will be puchased by individuals and libraries, and will ultimately become self-supporting. It is to be hoped that the academies of the country will unite in a plan of this character, and that our academy will initiate the movement.

When we review the whole subject of the history and present status of the academy of sciences we must, I think, come to the conclusion that the function of the modern academy is now modest. Libraries, museums, research laboratories, government departments and universities have developed in a way that leaves no excuse for the academy of sciences to attempt competition with them. The university in its modern form seems to me most suitable for the central

institution, and when our universities are controlled and supported by the state and when there is only one university in a region, it seems to me that the university should administer the libraries, museums, research laboratories and the like, and that the academy of sciences will be essentially a part of the university. The national and local societies for each branch of science are the natural groups for meetings and discussions and for publication. Membership in an academy as an honor, the presidency as a distinction, foreign members, medals, prizes and the like, seem to me to belong to the childhood of science. So long as we are still in this state let us rejoice in our innocence, but what is charming in the child is intolerable in the man.

Has the academy of sciences then played its part in the world? Must it, like the mastodon and elephant, give way to organisms better suited to a changed environment? I have already indicated that I believe the academy to have important if modest functions, and have stated what I think them to be. They are essentially those of a guild. We need a center in each community for organization and social intercourse. As capitalists unite in corporations and laborers in trades unions, so men of science should unite in their academies. We should not profess unselfish philanthropy, but we may reasonably claim that whatever is accomplished to improve the condition of men of science, to increase their influence or to forward their work, is of benefit to the community and for the welfare of society.

J. McKeen Cattell.
Columbia University.

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*ANNUAL ADDRESS OF THE PRESIDENT OF THE ROYAL SOCIETY.**

President Huggins said that since the last anniversary the Society had lost by death nine Fellows and two foreign members. The deceased Fellows were Sir Joseph Gilbert, died December 23, 1901, aged 84; the Marquis of Dufferin and Ava, died February 12, aged 75; Maxwell Simpson, died February 25, aged 86; Sir Richard Temple, died March 15, aged 76; George F. Wilson, died March 28, aged 80; Sir Frederick A. Abel, died September 6, aged 75; Dr. John Hall Gladstone, died October 6, aged 75; William Henry Barlow, died November 12, aged 90; Sir William C. Roberts-Austen, K.C.B., died November 22, aged 59. The foreign members were Alfred Cornu, died April 12, aged 61; Rudolf Virchow, died September 5, aged 80. Not the Royal Society only, but mankind, he said, had sustained grievous loss by the deaths of two of the foreign members. Rudolf Virchow left a record of intellectual achievement unsurpassed in its high distinction and value, its exceptional and sustained vigor during a life unusually prolonged, and its remarkable variety. In his own country Virchow would be remembered not only as the distinguished pioneer in pathological science, but also as an influential politician and a great social and municipal reformer. He had been many times in England. He was present at the Medical Congress held in London in 1881. In the Croonian lecture, delivered before this Society in 1893, he reviewed, in his own masterly way, the progress of pathological physiology. Five years later he gave the Huxley lecture at the Charing-cross Medical School, when he took for his subject 'Recent Advances in Physiology'; Lord Lister and Sir James Paget being present to do him honor. At the celebration of his 80th birthday at Berlin, in 1901, the Royal Society was represented by Lord Lister. Virchow was born in 1821. He was elected a foreign member of the Royal Society in 1884; eight years later the Royal Society conferred upon him their highest

* From the London *Times*.

honor, awarding him the Copley medal. France lost in Alfred Cornu one of the most distinguished of her men of science. Possessed of rare perspicacity of intellect and of resourcefulness in experiment, by his numerous researches, especially in the domain of optics, he had won no mean place as an original contributor to science. On his part, Mme. Cornu wrote in a private letter that he especially appreciated and reciprocated the friendship and sympathy of his English colleagues. Cornu was born in 1841; he was elected a foreign member of this Society in 1884; he received the honorary degree of Doctor of Science from the University of Cambridge in 1899; and died, in the spring of this year, mourned and deeply regretted by the whole scientific world. It was with deep regret that he recorded the loss which the Society had sustained by the decease of Sir Frederick Abel, who held for many years a conspicuous position in the world of science, and in public life, in connection with technical education and the Imperial Institute. His services were recognized by a baronetcy, by K.C.B., and by the G.C.V.O. In 1887 he was awarded a Royal medal by the Council. They had also to record with sorrow the death of Sir Henry Gilbert, the fellow-worker with the late Sir John Bennet Lawes in the famous agricultural experiments carried on for a long series of years by them at Rothamsted. Dr. Gladstone's work was remarkable for its varied nature, and he was among the first to labor in the borderland between chemistry and physics. He was awarded the Davy medal in 1897. He was the first president of the Physical Society, and later president of the Chemical Society, and he served on two Royal Commissions.

After referring to the King's illness and the special sympathy felt by the Society on account of his Majesty's close relationship with them as a former Fellow and now their patron, their deep joy on his recovery, and their satisfaction on the coronation of the King and Queen, the president said that the Prince of Wales, who was elected a Fellow eight years ago, was pleased to attend the ordinary meeting of the Society on February 6 for the purpose of being formally admitted into the Society, introduced by Lord Salisbury, then Prime Minister. On that occasion the Prince said: "I am indeed proud that my name should be added to those on your illustrious roll, which has been inscribed by nearly every sovereign since the reign of Charles II. and by all of the most distinguished men of science since those days. I can assure you of my hearty sympathy with that scientific study and research which now, more than ever, has become so important and essential in our national life." They bade a hearty welcome to the new society which had recently received a royal charter for the organization and promotion of those branches of learning which, in foreign academies, were usually included in the philosophico-historical section. This new body, under its adopted title of 'The British Academy for the Promotion of Historical, Philosophical and Philological Studies,' would, they sincerely trusted, take a worthy place by the side of the older and very distinguished institutions, the Royal Society and the Royal Academy, in representing the intellectual activities of the kingdom, though, in accordance with the sentiments and habits of the national character, each society retained its complete independence, and was in no way subservient to the state. The present council having reaffirmed the view taken by the council of last year, that it would not be desirable to attempt to include the studies undertaken by the newly-formed body as an integral part of the work of the Royal Society, they might rejoice that they would now be cared for by an independent so-

ciety. Though the words of the charter granted by Charles II. were wide enough legally to include historical and philosophical studies, yet, as a matter of fact, with some few exceptions in early days, the work of the Royal Society had been confined for two centuries and a half to the studies with which it was now occupied. It would be their pleasant duty, as the Acting Academy of the International Association of Academies, to recommend the new society for admission into the 'Association of Academies' as the body representing philosophico-historical science in the United Kingdom.

After referring to the National Antarctic Expedition, and the arrival of the *Morning* in New Zealand, which place she was leaving this month in search of the *Discovery*, the president referred to the establishment of a National Physical Laboratory, the opening of which had taken place since the last anniversary. He then described the work of the Physikalisch-technische Reichsanstalt, of Berlin, which was largely due to the scientific foresight of von Helmholtz. The original cost of the institute was over £200,000, and its yearly maintenance was not less than £17,000. During the five years that it had been at work its influence upon the science and the manufacturing interests of Germany had been most remarkable. It was, therefore, with feelings of high satisfaction that he had to record the opening in March last of a similar national institution in this country. The sum voted by the government for the physical laboratory, an institution second to none in its national importance, was the very modest one of £13,000 for the buildings and equipment, and an annual grant of £4,000 for five years in aid of the expenses of conducting the work of the institution. It was, therefore, 'to the liberality of the public,' as the Prince of Wales at the opening pointed out, 'that we must look not only for money, but also for presents of machinery and other appliances.'

The supreme necessity in this country of a more systematic application of scientific methods, both in theory and in practice, to our manufactures and industries, which was so wisely insisted upon by the Prince of Wales on the occasion of his admission to the Fellowship of the Society, and again in his address at the opening of the National Laboratory, had since been confirmed and enforced in a remarkable way by the individual testimonies of thirteen Fellows of this Society in the evidence which they recently gave from their own knowledge and experience, either as teachers of science or as leaders and technical advisers in manufactories or commercial undertakings, before a committee of the London Technical Board. The evidence seemed clear that the present inappreciative attitude of our public men, and of the influential classes of society generally, towards scientific knowledge and methods of thought must be attributed to the too close adherence of our older universities, and through them of our public schools, and all other schools in the country downwards, to the traditional methods of teaching of medieval times. With the experience of Germany and the United States before us, the direction in which we should look for a remedy for this state of things would seem to be for both the teacher and the student to be less shackled by the hampering fetters of examinational restrictions, and so for the professor to have greater freedom as to what he should teach, and the student greater freedom as to what line of study and research he might select as being best suited to his tastes and powers. In the United States the candidate for the highest degree, Ph.D., must spend at least two years, after obtaining his bachelor degree, in carrying out an

investigation in the field of his main object of study, and then submit the dissertation which embodied the results of his research. One way of bringing about reform in this direction would be to make individual research an indispensable condition of proceeding to degrees higher than the B.A. The first steps in the direction of true reform must be taken by the universities in the relaxation to some extent of the established methods and subjects of their examinations, which had been carried down with but little change from the Middle Ages. It was some satisfaction to know that a new section of the British Association for the Advancement of Science had been formed for the consideration and discussion in detail of the reforms which were needed in the educational methods of the country. In the meanwhile much might be done provisionally by their Fellows, in their individual capacity, by stimulating and directing wisely the increased attention which was now being given to science in all departments of life, and especially in fostering and extending the many technical colleges and institutions which were being established in all parts of the country. The fellows would view with no little satisfaction the fact that the King had been pleased to recognize the importance of science being represented on the highest judicial body in the kingdom by the appointment of two of their fellows as privy councillors.

The Copley medal was awarded to Lord Lister in recognition of the value of his physiological and pathological researches in regard to their influence on the modern practice of surgery. When in 1880 a Royal medal was awarded to him, it was acknowledged that his researches had 'not only reformed the whole art of surgery, but given a new impulse to medical science generally.' The experience of another twenty years had written out that judgment in still larger letters. Lister's researches had made the world a wholly different world from what it was before. The Rumford medal was given to the Hon. Charles Algernon Parsons for his success in the application of the steam turbine to industrial purposes, and for its recent extension to navigation. The work of Mr. Parsons was of a kind which specially came under the terms and conditions of the Rumford medal, as consisting 'of new inventions and contrivances by which the generation and preservation and management of heat and of light may be facilitated' and as 'shall tend most to the good of mankind.' By his invention and perfection of the steam turbine he had not only provided a prime mover of exceptional efficiency, working at a high speed without vibration, but had taken a step forward, which made an epoch in the history of the application of steam to industry, and which was probably the greatest since the time of Watt. A Royal medal was awarded to Professor Horace Lamb for his investigations in mathematical physics. Professor Lamb had been conspicuous during the last twenty years by the extent and value of his contributions to mathematical physics. His writings had been distinguished by clearness, precision, and perfection of form. The other Royal medal was conferred upon Professor Edward Albert Schäfer for his researches into the functions and minute structure of the central nervous system, especially with regard to the motor and sensory functions of the cortex of the brain. The Davy medal was awarded to Professor Svante August Arrhenius for his application of the theory of dissociation to the explanation of chemical change. It was not easy to over-estimate the importance of the service rendered to chemistry by Professor Svante Arrhenius through the publication of his memoir, presented to the Swedish

Academy of Sciences on June 6, 1883, entitled 'Recherches sur la Conductibilité Galvanique des Electrolytes.' The Darwin medal was conferred upon Mr. Francis Galton, F.R.S., for his numerous contributions to the exact study of heredity and variation contained in 'Hereditary Genius,' 'Natural Inheritance,' and other writings. The work of Mr. Galton had long occupied a unique position in evolutionary studies. His treatise on 'Hereditary Genius' (1869) was not only what it claimed to be, the first attempt to investigate the special subject of the inheritance of human faculty in a statistical manner and to arrive at numerical results, but in it exact methods were, for the first time, applied to the general problem of heredity on a comprehensive scale. It might safely be declared that no one living had contributed more definitely to the progress of evolutionary study, whether by actual discovery or by the fruitful direction of thought, than Mr. Galton. The Buchanan medal, awarded every five years for distinguished services to hygienic science or practice, was given to Dr. Sydney A. Monckton Copeman for his experimental investigations into the bacteriology and comparative pathology of vaccination. The Hughes medal was awarded to Professor Joseph John Thomson in recognition of his contributions to the advancement of electrical science, especially in connection with the phenomena of electric discharge through rarefied gases. By virtue of Professor Thomson's own investigations, and of many others inspired and stimulated by him, this new field of knowledge had been widely extended, and it could hardly be doubted that the progress of this new department of knowledge would gradually enable us to see one whole stage deeper into the sources of physical phenomena.

THE CARNEGIE INSTITUTION.

RULES OF THE CARNEGIE INSTITUTION RELATIVE TO GRANTS FOR RESEARCH.

Adopted Nov. 26, 1902.*

(1) Applications for grants may be made at any time and should be addressed to the Carnegie Institution, Washington, D. C.

(2) The Executive Committee will carefully consider each application and decide upon it, but will not assign reasons for declining in cases where grants are deemed inexpedient.

(3) When a grant is made the applicant will be promptly notified to that effect.

(4) When a grant is declined the applicant will be promptly notified to that effect.

(5) An account of all expenditures, accompanied by detailed vouchers, must be rendered by the recipient from time to time as payments are made, and a complete statement at the conclusion of the investigation.

(6) All apparatus, books, and materials purchased with and all collections made by means of grants from the Carnegie Institution are the property of the Institution, are subject to its disposition, and are to be accounted for.

(7) A grant made for a specified purpose can be used for that purpose only. If the recipient desires to change in any manner the subject of his investigation, he should make an application, in the usual form, for a new grant.

(8) Any part of an appropriation not needed for completing the investigation for which the grant was made shall be returned to the Institution.

(9) Payments of grants will, in general, be made quarterly, but in special cases may be made more frequently.

* These rules appear on back of Application printed on opposite page.

CARNEGIE INSTITUTION*

APPLICATION FOR GRANT IN AID OF RESEARCH

CARNEGIE INSTITUTION
Washington, D. C.

I hereby apply to the Carnegie Institution for a grant of $.....
for the purpose of conducting an investigation as follows:

[Object of investigation concisely stated; details, when necessary, in accompanying letter]

[How proposed grant is to be expended]

[How payments are desired—*i. e.*, whether in a single sum or in instalments, and at what dates]

As to the above request, I agree that

(1) I will enter upon the proposed research forthwith and prosecute it diligently.

(2) I will place in the hands of the Secretary of the Institution on or before November 1, 190....., and at such other times as may be called for, a report of progress made and results achieved, with an itemized statement of expenditures.

(3) I will not publish the results without first offering the manuscript to the Carnegie Institution for publication.

(4) When the results are published, I will make due acknowledgment of the aid given by the Carnegie Institution, and, if the results are not published by the Institution, I will furnish it, at my own cost, with four copies of the publication.

(5) In case a grant is made, I will strictly conform to the rules printed on the back of this application.

Respectfully submitted,

[Name].....

[Address] .....

Date.....*190* .

[OVER

* We reproduce, without comment, the form of contract that must be signed by men of science who apply for grants from the Carnegie Institution.

SCIENTIFIC BOOKS.

The Mind of Man: A Text-book of Psychology. By Gustav Spiller. London, Swan Sonnenschein & Co.; New York, The Macmillan Co. 1902. Large 8vo. Pp. 552.

Text-books in psychology that may be recommended to the devotees of other sciences, and that offer excellent starting points for the discussion of the living problems about which psychological progress centers, are the exception rather than the rule. When combined with this there is a decided originality of presentation and a freshness of outlook and a happy facility of illustration, the recommendation may be made more emphatic. All of this is true of the work of Mr. Gustav Spiller. Apart from one or two articles in the philosophical periodicals, the author's name is new to the psychological public; but the present volume will certainly make it a familiar one in psychological discussion.

With so many merits—and these not the usual ones—the volume has certain serious defects. The adoption of a strange and unfamiliar, though intelligible, terminology effects a slight gain in precision by the sacrifice of the greater good of the greater number, and really seems unnecessary to the purpose. The treatment of the opinions held by others is cavalierish, to say the least. It seems almost the foregone conclusion of the author that the current or the popular opinion on any topic is the wrong one; whatever is, is wrong. Only occasionally is the extreme form of this tendency manifest; usually it is tempered by a fair statement of the opinion current in the literature. And it should be added at once that the utilization of the literature of the field and the convenient arrangement of the bibliography add to the serviceableness of the whole. None the less the author's bias in favor of the unusual and the neglected leads him more than once to underestimate the force of opposing views and to dwell too exclusively upon the evidence that appeals to his own bent.

The opening blast prepares one for innovation. "I maintain not only that the elementary principles of psychology have still to be established; but I believe that, from the scientific point of view, no serious attempt has yet been made in that direction." Unchallenged tradition, imitative remodeling of current views, a defective sense of reality, have kept alive the opinions that influence psychology. The watchword of the moment is 'Back to observation.' And the observation that is most fertile is that of trained introspection. The introspective method is *the* psychological method and must ever remain so. Those who have questioned either its validity or its efficiency have been unaware of its possibilities in trained minds. It requires a skilful mechanic to use a complicated tool; and the psychologist has been the poor mechanic laying the fault of his own defective insight upon the imperfection of his tool. "There is scarcely a passion so wild, or a dream so subtle, that a trained psychologist cannot collectively turn round and with freedom inspect the related processes." Experimental introspection is the key that will unlock the real problems of psychology.

The paramount doctrine of psychology is that mental processes are determined by needs; that the aspect of mental processes that should stand out boldest in the perspective, and should dominate every detail as well, is the functional one. Association, habit, memory, imagination, attention, all travel along the psychological highways in response to certain organic needs. The study of these needs is the study of psychology. "Psychology treats of the nature and the satisfaction of those distinctive needs which are connected with the central nervous system, and this it treats of in systematic conjunction with the system of sights, sounds, smells, etc., which are developing concurrently; *i. e.*, psychology treats of the needs which arise out of the relations of the various systems in the organism, and out of the relation of that organism to its environment."

Apart from this method of approach—which in many ways represents a view of the topic that others in writing and teaching are emphasizing, though with different motive—it is likely that the book will carry more weight and more interest by reason of the skill with which the several chapters support their

themes. It is the fertility and pertinence of illustration, the masterly marshaling of facts, the discernment that detects the crucial points of difference and is not deceived by the current or surface view of things—these will be the traits that will measure the value of the work to the progress of psychology. Accordingly, the volume may be set down as one of those that has a literary style and a capacity to make the reader think. He will not always think as the writer does; but he will never listlessly muse as his eyes scan the pages, nor idly accept as dogma what is offered to his understanding.

The scope of the volume may be said to include those phases of discussion that deal with thought as a whole; with the succession of waves of consciousness and the composition of these waves. Habit, memory, imagination, dreams, originality, language, reasoning, attention, willing, emotional and esthetic products, are all subjects of chapters with headings the appropriateness of which the reader will recognize only as he proceeds. There is no detailed study of the senses nor of the nervous system; for it is maintained that science has progressed only so far that general illustrations of these alone find a place in the psychology now possible. The results of the experimental or laboratory psychology are regarded as too incomplete and too artificial to modify more than incidentally the more vital considerations that flow from experimental introspection. Genetic sources are considered; though the topic is the mind of man, and thus deals but little with the minds of animals.

The opinion is frequently heard that, in spite of the enormously increased attention that is now given to psychological matters, and in spite of the conviction, only occasionally challenged, that psychological principles have great potency to guide the practical path of culture and education, yet so little that is tangible enough to be summarized and entered to the credit side of the progressive inventory of science can be written upon the pages allotted to psychology. Apart from the pertinent query as to how far such difficulty is itself significant, it may well be concluded that psychology might profit by a shaking up rather than by efforts to harmonize essentially opposed tendencies; that the time has come, not for repairing old clothes, but for making new ones. Those who feel that there is some force in such considerations, as well as many others whose interest in matters psychological is less comprehensive or less professional, will find much food for reflection—and food pleasantly prepared and vigorous withal—in the pages of Mr. Spiller's notable work.

JOSEPH JASTROW.

Archiv für Protistenkunde. Edited by DR. FRITZ SCHAUDINN in Rovigno, Istria. Jena, published by Gustav Fischer. Price, M. 24 per Band.

In the future, as in the past, it is not improbable that works dealing with the unicellular plants will continue to be published in botanical journals, and papers dealing with the bacteria will appear sometimes in one and sometimes in another, or that monographs on the Protozoa will still be brought out in strictly zoological periodicals. This will involve the continuation of an old bibliographical difficulty for those investigators whose problems carry them into the more general aspects of the unicellular organisms. These difficulties may, however, be considerably lessened if students of the several groups mentioned would send their contributions to the *Archiv für Protistenkunde.* This is a journal devoted exclusively to the publication of papers upon the unicellular organisms, and under the direction of one of the most capable students of these forms. It is sincerely to be hoped that the object of the new journal will be fulfilled, and that students of the unicellular plants and animals in America will interest themselves in the project and contribute to its support.

Two numbers of the *Archiv* have already appeared, and the contents of the first give an adequate view of the scope of the periodical. In this there are six contributions which vary in length from two or three pages, as in Prowazek's note on *Trichomonas hominis,* to nearly eighty pages in Lohmann's excellent monograph on the Coccolithophoridæ or coc-

colith-forming Protozoa. The subject-matter is also varied, this first number for example containing the following contributions:

1. 'Die Protozoen und die Zelltheorie.' An essay by Professor Richard Hertwig replete with excellent points and suggestive ideas.

2. 'Bemerkungen über Cyanophyceen und Bacteriaceen.' A special morphological paper by Professor Otto Bütschli on the nature of the so-called *Centralkörper* in certain species of Nostocaceæ and Bacteria.

3. 'Beiträge zur Kenntnis der Colliden.' A systematic paper by Professor Karl Brandt on one of the orders of the Peripylarian Radiolaria.

4. 'Die Coccolithophoridæ.' A morphological, and systematic paper by Dr. K. Lohmann on these little-known phytoflagellates.

5. 'Notiz über die *Trichomonas hominis*.' A note by Dr. S. Prowazek on a human parasite.

6. 'Das System der Protozoen.' A proposed classification of the Protozoa by Dr. F. Doflein.

The *Archiv* is to appear at irregular intervals and without set limits as to size. Contributions in English, German and French will be printed in these languages without German summaries.

We heartily wish for the success which the new undertaking deserves.

G. N. C.

SCIENTIFIC JOURNALS AND ARTICLES.

The Journal of Physical Chemistry, November. 'Alloys of Lead, Tin and Bismuth,' by E. S. Shepherd. A quite complete study of these alloys, from which the conclusions are drawn that from them the tin crystallizes pure, but often in an unstable denser form; and that lead and bismuth form two series of solid solutions, in each case with contraction. When the fused alloys are cooled fairly rapidly the saturation concentrations are not reached. A bibliography accompanies the paper. 'Influence of the Solvent in Electrolytic Conduction,' by Harrison Eastman Patten. A paper from the University of Wisconsin presenting the following conclusions among others: The lowering of the specific electrical conductivity of non-aqueous solutions by addition of a pure solvent has been found to be approximately proportional to the number of gram-molecules of solvent added. Here is offered a new method for molecular weight determinations. Electrical conductivity seems to be the resultant of: (1) The tendency of some molecules to transfer the charge produced by an impressed electromotive force, and (2) the resistance offered to this transfer of charge by other molecules. Conduction of electricity by solutions depends upon the fact that a compound is formed by the solvent and solute when solution takes place.

The *Botanical Gazette* for November contains the following papers: D. S. Johnson contributes additional morphological information in reference to the Piperaceæ, describing the ovule, seed and fruit of *Piper;* the development and germination of the seed of *Heckeria;* and the germination of the seeds of *Peperomia* and *Heckeria*. The development of the ovary, ovule and embryo-sac in *Piper* and *Heckeria* differs widely in several respects from that found in the related genus *Peperomia*. *Piper* and *Heckeria* differ strongly from one another in the formation of endosperm, which in the former begins with free nuclear division, and in the latter with cell formation. In germination the swelling of the endosperm and embryo bursts the seed coats and the endosperm protrudes through the rent as a sac which continues to surround the embryo until foot, root and cotyledons are differentiated. The author concludes that the aleurone containing endosperm of these forms acts as a digesting and absorbing apparatus for transferring the starch stored in the perisperm to the embryo. He calls attention to several other genera in which a small amount of endosperm separates periplasm and embryo and seems to serve this function. Henry Kraemer discusses the structure of the starch grain, the results of his observations being that the starch grain consists of colloidal and crystalloidal substances, these being arranged for the most part in distinct and separate lamellæ. The reason that this struc-

ture is not apparent under natural conditions is because the refractive properties of the crystalloidal substances so nearly resemble those of the associated colloidal substances. Aven Nelson publishes his fourth 'Contributions from the Rocky Mountain Herbarium,' dealing with Chenopodiaceæ, *Cratægus*, and a number of miscellaneous species. A number of new species are described and a new genus allied to *Argemone* is proposed. Alexander W. Evans describes a new liverwort (*Diplophylleia apiculata*) from the eastern United States.

SOCIETIES AND ACADEMIES.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE fifty-second annual meeting of the American Association for the Advancement of Science, and the first of the Convocation Week meetings, will be held in Washington, D. C., December 27, 1902, to January 3, 1903. The retiring president is Professor Asaph Hall, U.S.N., and the president elect, President Ira Remsen, Johns Hopkins University. The permanent secretary is Dr. L. O. Howard, Cosmos Club, Washington, D. C., and the local secretary, Dr. Marcus Benjamin, Columbian University, Washington, D. C. President Roosevelt is honorary president of the local committee. The preliminary program with information in regard to hotel headquarters, railway rates, etc., will be found in the issue of SCIENCE for November 21. The following scientific societies will meet at Washington in affiliation with the Association:

The American Anthropological Association will hold its first regular meeting during Convocation Week in affiliation with Section H of the A. A. A. S. President, W J McGee; secretary, George A. Dorsey, Field Columbian Museum, Chicago, Ill.

The American Chemical Society will meet on December 29 and 30. President, Ira Remsen; secretary, A. C. Hale, 352A Hancock street, Brooklyn, N. Y.

The American Folk-lore Society will meet in affiliation with Section H of the A. A. A. S. President, George A. Dorsey; vice-presidents, J. Walter Fewkes, James Mooney; secretary, W. W. Newell, Cambridge, Mass.

The American Microscopical Society will probably hold a business meeting on December 29. President, E. A. Birge, Madison, Wis.; secretary, H. B. Ward, University of Nebraska, Lincoln, Nebr.

The American Morphological Society will meet on December 30 and 31. President, H. C. Bumpus; vice-president, G. H. Parker; secretary and treasurer, M. M. Metcalf, Woman's College, Baltimore, Md.

The American Philosophical Association will meet on December 30 and 31 and January 1. Secretary, H. N. Gardiner, Northampton, Mass.

The American Physical Society will meet in affiliation with Section B of the A. A. A. S. President, Albert A. Michelson; secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

The American Physiological Society will meet on December 30 and 31. President, R. H. Chittenden; secretary, F. S. Lee, Columbia University, New York, N. Y.

The American Psychological Association will meet on December 30 and 31 and January 1. President, E. A. Sanford; secretary and treasurer, Livingston Farrand, Columbia University, New York, N. Y.

The American Society of Naturalists will meet on December 30 and 31. President, J. McK. Cattell; vice-presidents, C. D. Walcott, L. O. Howard, D. P. Penhallow; secretary, R. G. Harrison, Johns Hopkins University, Baltimore, Md.

The Association of American Anatomists will meet on December 30 and 31. President, G. S. Huntington; vice-president, D. S. Lamb; secretary and treasurer, G. Carl Huber, University of Michigan, Ann Arbor, Mich.

The Association of Economic Entomologists will meet on December 26 and 27. President, E. P. Felt; secretary, A. L. Quaintance, College Park, Md.

The Astronomical and Astrophysical Society of America will meet during Convocation Week, in affiliation with Section A of the A. A. A. S. President, Simon Newcomb; secretary, George C. Comstock, University of Wisconsin, Madison, Wis.

The Botanical Society of America will meet on December 31 and January 1. President, B. T. Galloway; secretary, D. T. MacDougal, New York City.

The Botanists of the Central and Western States will meet on December 30. Committee in charge of the meeting, John M. Coulter, University of Chicago; D. M. Mottier, University of Indiana, Bloomington, Ind.; Conway MacMillan, University of Minnesota, Minneapolis, Minn.

The Geological Society of America will meet on December 29, 30 and 31. President, N. H. Winchell; vice-presidents, S. F. Emmons, J. C. Branner; secretary, H. L. Fairchild, University of Rochester, Rochester, N. Y.

The National Geographic Society will hold a meeting during Convocation Week. President, A. Graham Bell; vice-president, W J MeGee; secretary, A. J. Henry, U. S. Weather Bureau, Washington, D. C.

The Naturalists of the Central States will meet on December 30 and 31. Chairman, S. A. Forbes; secretary, C. B. Davenport, University of Chicago, Chicago, Ill.

The Society of American Bacteriologists will meet on December 30 and 31. President, H. W. Conn; vice-president, James Carroll; secretary, E. O. Jordan, University of Chicago, Chicago, Ill.; council, W. H. Welch, Theobald Smith, H. L. Russell, Chester, Pa.

The Society for Plant Morphology and Physiology will meet during Convocation Week. President, V. M. Spalding; vice-president, B. D. Halsted; secretary and treasurer, W. F. Ganong, Smith College, Northampton, Mass.

The Society for the Promotion of Agricultural Science will meet during Convocation Week. President, W. H. Jordan; secretary, F. M. Webster, Urbana, Ill.

The Zoologists of the Central and Western States will meet during Convocation Week. President, C. B. Davenport, University of Chicago.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

At the 132d meeting of the society, held in Washington, November 12, the following papers were presented:

'A Deposit of Titanic Iron Ore from Wyoming,' by W. Lindgren.

Recent and very valuable studies of deposits of titanic iron ores have been contributed by Kemp and Vogt. A perusal of these works led to the publication of the following note on Iron Mountain, Wyoming, which locality I visited in 1896.

Most of the deposits of titanic iron ore form irregular masses or fairly sharply outlined streaks in gabbro, or still more commonly in anorthosite (labradorfels). Distinct dikes, undoubtedly indicating separate igneous injection of molten magma of titanic iron ore, have, however, also been described by Kemp from the Calamity Brook district in the Adirondacks, and by Vogt from near Ekersund, Norway, and the locality in Wyoming is chiefly interesting as belonging to this type.

Iron Mountain is situated in the southeastern part of Wyoming, about forty miles north of Cheyenne, and in the foothills of the Laramie Hills. It is eight miles west of the railroad station of Iron Mountain. The rocks prevailing here are chiefly Paleozoic limestones and sandstones, in rolling folds, and these continue for six or seven miles up Chugwater Creek. The dips here become steeper and the underlying pre-Cambrian rocks appear. As far as my observations went they consist exclusively of a labradorite rock of coarse grain which forms rough gray outcrops. The rock can scarcely be called a gabbro, for the pyroxene grains are very sparingly distributed. It contains very little magnetite or ilmenite. Going up one mile farther, the chief deposit is encountered; it crosses the canyon of the Chugwater as a solid dike 100 to 200 feet wide, and can be seen extending up several hundred feet in elevation on both sides of the creek. The mass is said to be traceable for half a mile north and south of Chugwater Creek. The amount of iron ore in sight is most remarkable. The contacts are not exposed to best possible advantage, but have the appearance of being sharp and well defined. The black titanic iron ore seems entirely pure and free from accompanying minerals; at least a search along the base of the outcrop revealed no other constituents of the mass.

About 400 feet below the main deposit there is exposed in the southern wall of the canyon a smaller dike only about ten feet wide. The contacts are well exposed and show a medium grained gray labradorite rock abutting sharply against the dike of titanic iron ore. The dike does not continue on the north side of the canyon, the bottom of which is filled with considerable débris. The greater part of the width of the dike is composed of massive titano-magnetite; but adjoining the western contact the iron ore for a width of one or two feet contains large, imperfect crystals of olivine imbedded in a cementing mass of the black mineral. This association of olivine

and titano magnetite is somewhat unusual; Professor Vogt, in fact, declares that it is not known to occur (*Z. f. Prakt. Geol.*, 1900, p. 292) in the differentiated ores. The black mineral immediately adjoining the olivines contained, upon qualitative test, a large amount of titanium.

This locality has been described by Mr. Arnold Hague in Vol. II. of the 'Reports of the Survey of the 40th Parallel,' pp. 12–16, but the county rock as described by him is a reddish granite, an analysis of which is given. Evidently the points where Mr. Hague saw the deposit were not the same as the locality here described, for the dike, as noted, extends over a considerable distance. The only granitic rock observed at the place described was a small, dike-like mass of fine-grained biotite-granite on the north side of the canyon, nearly opposite the smaller dike of iron ore.

A review of the available facts relating to this interesting locality, which merits further investigation, is to be found in J. F. Kemp's 'Brief Review of the Titaniferous Magnetites' in *School of Mines Quarterly*, Vol. XX., No. 4, 1899.

The analysis of the titano-magnetite by J. P. Carson (F. V. Hayden, U. S. Geol. Surv. Terr., 1870, p. 14) gives the following result:

SiO_2	.76
TiO_2	23.49
Al_2O_3	3.98
Cr_2O_3	2.45
Fe_2O_3	45.03
FeO	17.96
MnO	1.38
MgO	1.56
CaO	1.16
P_2O_5	Tr.
S	1.44
ZnO	.47
	99.78
Fe	45.49%

Noteworthy is the large percentage of sulphur, indicating the presence of sulphides, none of which was, however, observed in the specimens. Further, the notable percentage of zinc, a metal very unusual in the titano-magnetites. There is also an unusually large amount of Cr_2O_3 present.

Mr. Alfred H. Brooks presented a paper entitled 'A Reconnaissance in the Mt. McKinley Region, Alaska,' which was the preliminary announcement of the results of an exploration made during the past season.

Alaska is divisible into the same four geographic provinces as those of western Canada and the United States, which are the Pacific Mountain System, the Central Plateau Region, the Rocky Mountain System, and the Arctic Plain Region. The area investigated lay in the first of these two provinces.

The Pacific Mountain System is made up of a number of distinct ranges, of which the rugged Alaskan lies farthest inland and is the highest, embracing Mt. McKinley, the highest peak on the continent. It extends in a northeasterly and easterly direction from the vicinity of Lake Clarke to the Tanana River, separating the Cook Inlet drainage on the south from the Kuskokwim and Yukon waters on the north. The crest line of the range lies near its western and northern side, where the mountains fall off abruptly to a gravel-covered plateau which slopes down to the Kuskokwim lowland. The southern slope of the range also rises rather abruptly from the Sushitna Valley lowland.

A journey of some eight hundred miles was made on foot, while a pack train of twenty horses was employed to transport the provisions and equipment of a party of seven men. The expedition left Tyonok, Cook Inlet, on June 1, and, taking a northerly course, reached the mouth of the Keechatna a month later; then turning westward, crossed the Alaskan Range by an unmapped pass to Kuskokwim waters. Thence the route northeastward, along the western base of the great Alaskan Range, was traversed to the Cantwell River. An exploration of the headwaters of the left fork of the Cantwell was made and then the party turned northward across the Tanana and reached the Yukon at Rampart on September 15.

The continuous instrumental survey of the whole route forms a connecting link between a number of reconnaissance surveys which had been made in previous years by the Geological Survey. Much interesting and val-

uable data were obtained in regard to the northern and western front of the Alaskan Range, which had not previously been explored. The position and altitude (the latter with a probable error of not over 100 feet) was determined by Mr. D. L. Reaburn, topographer of the expedition. It is of interest to note that Mt. McKinley is definitely determined to be over 20,000 feet and Mt. Foraker 17,000 feet.

The notes and specimens having not yet been studied, but few statements can be made in regard to the bed-rock geology, which is complex and embraces terranes from the Silurian to the Carboniferous.

The oldest terranes were found in the northern part of the area, and consist of a metamorphosed conglomerate, often having a gneissic phase. The lowest member of this series is not distinguishable from a true Archæan gneiss and it possibly belongs to a crystalline basal complex. Overlying the conglomerate, a slate and phyllite series was found, succeeded by limestones and slates and arenaceous beds carrying Ordovician fossils. Devonian limestones were found widely distributed. The Paleozoic rocks are intensely folded and faulted. At least one, and probably two, unconformities occur within the Paleozoic, one near the base of the Devonian and a second probably in the Silurian.

In the southern part of the area there is a vast thickness of shales, slates, grits and sandstones, in which Jurassic fossils were found. These were, in the section studied, well exposed across the range. This series thins out to the northward, and near the Tanana is entirely wanting. It is overlaid unconformably by sandstones, conglomerates and shales, which carry coals. The plant remains from these beds, studied by Dr. F. H. Knowlton, show it to be of Arctic Miocene or Eocene age. These Tertiary beds have a limited development in the southern part of the belt, but thicken to the northward. On the Cantwell a section of 3,000 feet was measured. The only other consolidated beds found in the region were some lignitic bearing friable sandstones, which were found in the southern part of the belt. These aggregate probably not over 200 feet and are probably of late Tertiary age.

Among the plentiful intrusive rocks there are two important lines of granite, one east of the mountains along the axis of the Sushitna Valley, and a second along the axis of the Alaskan Range, where the highest peaks, such as Mt. McKinley and Mt. Foraker, are probably chiefly made up of granite. Various other granular rocks occur as dikes and stocks.

Extrusive rocks are found along both flanks of the range, but do not seem to compose the range itself. They are mainly of post-Eocene age. The active volcanoes of the Aleutian Islands and the Alaskan Peninsula do not extend into the region under discussion, though some of their ejecta are found mingled with the recent alluvial deposits.

Evidence of glaciation is abundant in the region south of the Tanana Valley. Glacial till and erratics were found along the western shore of Cook Inlet, and are closely associated with stratified sands and gravels. The foothills of the main range, 2,000 feet high, forty miles inland, were found glaciated, and, going westward into the mountains, the upper limit of glaciation was found at an altitude of about 4,000 feet. On the north side the base of the mountains is glaciated and the valleys up to 4,000 or 5,000 feet wide. On both sides of the range there are heavy gravel deposits, which mantle the base of the mountains. These are interpreted as overwash deposited during the retreat of the ice. Remnants of this greater ice sheet are to be found in the glaciers which now occupy many of the higher valleys, on both slopes of the Alaskan Range.

Alfred H. Brooks,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON.

The 361st meeting was held on Saturday, November 29.

William Palmer discussed the 'Variation of the Downy Woodpecker in Eastern Maryland and Virginia.' The speaker showed the extent of variation of the white markings of the wing coverts of the two subspecies found in the above region, as well as that of intergrading individuals. *Dryobates pubescens*

and *Dryobates pubescens medianus* were stated to intergrade along the western side of tide water in the region named, and the range of *medianus* was extended from South Carolina to this section.

Vernon Bailey spoke of 'Sleepy Grass and its Effects on Horses,' stating that this grass grew luxuriantly in some sections of the California Sierras. Horses eating this grass were rendered very drowsy for several days, and it was reported that in some instances they were temporarily too sleepy for use. The effects gradually wore off, and it was said that horses or cattle having eaten this grass would not do so a second time.

F. V. Coville described 'The Use of Sagebrush among the Klamath Indians of Oregon' and illustrated by experiment the manner in which it was employed to make fire by friction. The reason that sagebush was particularly adapted for this purpose was due to the fact that the rings of growth were not of uniform texture, some being soft, others hard. Owing to this the end of a piece of this wood did not wear smooth, but remained rough, causing continued friction, and eventually producing enough heat to light the very dry bark employed in place of tinder.

O. F. Cook presented a paper on 'The Function of Latex in the Central American Rubber Tree,' presenting incidentally much information as to the habits of the tree and the production of rubber. It was stated that, while the tree throve in moist climates, this was not favorable to the yield of rubber, which was greatest after a dry season, and lack of acquaintance with this fact led to the attempt to cultivate rubber trees in unsuitable localities. From observation of this and plants with similar sap it was inferred that an important function of the latex was to check evaporation.

F. A. LUCAS.

THE RESEARCH CLUB OF THE UNIVERSITY OF MICHIGAN.

THE Club met on the evening of November 19 and listened to papers by Professors John A. Fairlie and S. L. Bigelow.

Dr. Fairlie discussed the Ohio situation in the relation of legislative enactments for municipal government; and Dr. Bigelow spoke on 'The Passage of a Direct Current through an Electrolyte when the Electromotive Force Applied is Small.' The speaker stated that every attempt to determine Le Blanc's decomposition points shows that small currents pass before such a point is reached. Attempts to account for these currents by means of polarization phenomena, including the idea of electric 'double layers,' by Nernst's osmotic theory, and by Helmholtz's 'convection currents,' were shown to be unsatisfactory. A new theory was suggested: that a gas (hydrogen or oxygen) on dissolving becomes differentiated to a certain extent into molecules with plus charges and molecules with minus charges which then act as carriers of electrical energy. Facts already known and new experimental evidence were adduced in favor of this view. It was further proposed to apply Thompson's corpuscular theory to solutions, a justification for this being found in the close analogies known to exist between substances in dilute solution and in the gaseous condition, and Thompson's theory was considered preferable to the theory of electrons as stated by Nernst. It was pointed out that this theory would account for the currents passing at low voltage, and possibly for conduction in solutions whose boiling and freezing points fail to indicate corresponding dissociation. It was expressly stated that this new idea does not conflict with the dissociation theory, but rather serves to support it, offering a plausible explanation of some apparent exceptions.

The article will appear in the December number of the *Journal of Physical Chemistry*.

FREDERICK C. NEWCOMBE,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE CARNEGIE INSTITUTION.

TO THE EDITOR OF SCIENCE: Munificent as is the endowment of the Carnegie Institution, it is safe to assume that most of the good things proposed for science in the official plans will be enjoyed only by future generations; important results can be attained on the probable income, but not results in many directions. It may be, too, that some of the

proposals lie near to the founder's heart, enough of them to exhaust most of the available resources. One thus feels some hesitancy in making suggestions, for fear the trustees are committed in piety to all they can 'broadly and liberally' carry forward.

But there is one possible group of enterprises of no little importance, that has received little direct mention. There are, namely, a number of scientific undertakings, some highly interesting in theory, some vitally useful in practice, and many both the one and the other, that can hardly be entered into by university teachers, and can be entered into by other scientists only under great disadvantages. At least this is true under present conditions, and will continue to be true until some broadly founded and liberally managed institution shows, by successful example, how such things should be done.

I refer to broad, complex, and, in many instances, very practical problems, whose solution depends in each case on the accumulation and skilled synthesis and re-synthesis of data falling within the fields of a number of different sciences. It is true that all sciences are compelled in these days to poach on their neighbors' preserves. But in some cases the facts must be sought, not mainly in one domain, and only exceptionally in others, but about equally in a number of different scientific domains, and they can be properly gathered from each domain and digested only by men of special aptitude and training. For an investigation of this type there is need of a force of workers, each skilled in a particular science, and all organized and cooperating for a common end, a condition that does not exist in universities, and exists only rarely and to a limited extent in other scientific foundations. Such organized bodies of men are needed to deal with the problems of temperance, of crime, of marriage and divorce, of pauperism, etc., and also to deal with the broader problems of ethics, within whose scope all these problems and many more are included. They are also needed by anthropology, in the broadest sense of the word, by sociology—which will probably never be a science till the need is supplied—and, finally, by metaphysics, to which the same remark applies.

The greatest defect of science is probably lack of organization, and until the defect is remedied, large investigations cannot be successfully undertaken. Its realm is no doubt minutely subdivided, like, say, the land of France, so that each worker enthusiastically farms his own little patch. But specialization is only one factor in organization, not the whole of it. Mutual aid, cooperation among workers is the other indispensable factor, and of that little is to be found among scientific men. The amount of highly trained brain substance that is used up in activities that merely call for the intelligence of a clerk, or even of a machine, is simply appalling. Little more than a dozen investigators at our universities have a clerk or stenographer, and I know of none who has at his disposal specialists in other scientific departments. Each attends to all his needs, from blacking his boots and writing with his hand, to gathering all his facts, with the aid of a few advanced students in the most favored cases, and thinking out his conclusions. Professor Münsterberg is right in asking larger salaries for scientific workers, though their portion in this respect is not intolerable. But their acute financial need is not private, but official; they need money to put into their work and make it truly efficient; to pay for labor-saving devices, to buy equipment, to hire clerks, to employ well-trained specialists as assistants. Science is organized as industry was during the later Middle Ages, when each smith hammered at his own forge, and every other worker labored alone, or with a few apprentices, at his workshop. It should be organized, at least for attack on the larger problems, as industry is to-day, where one organization, by the aid of many devices and of all necessary experts, begins with the raw material and ends with the finished product. Naturally, scientific organization will have its own problems, and it can not hope for a long time to be by any means as complete as industrial organizations, but a beginning should be made as soon, and under as favorable conditions, as possible. It is about as

reasonable to ask our scientists to-day to solve large problems, as it would be to furnish Mr. Schwab a coal and an iron mine, and ask him and a few miners to turn out a steel rail or a Baldwin locomotive.

If the Carnegie Institution would thoroughly organize bodies of workers in a few fields too large and complex for our present resources and methods, and furnish them with adequate supplies of all kinds, it would avoid duplication, and would, I venture to believe, set an inspiring example to our present scientific institutions, and attain reliable and relatively complete results of high value. And assuredly an institution founded by one of the foremost organizers of industry could do no better for science than to aid in its organization.

S. E. MEZES.
UNIVERSITY OF TEXAS.

TO THE EDITOR OF SCIENCE: With the accumulation of valuable papers from men of science in regard to the disbursement of the fund of the Carnegie Institution so as best to advance human knowledge, it has occurred to me that, as these papers have all been written by teachers or authors, it might not be out of place for a collector of facts (who has helped increase our knowledge of the extinct life of the earth during thirty-five years spent in the fossil fields of the West) to make a few remarks on this interesting topic, even though the years of early manhood were spent in the field and not the university. From long experience I can testify to the difficult life-work of a collector in America, when he gives all that he has to the advancement of pure science, and can well appreciate the remark of Professor E. D. Cope when he said to me several years ago: 'After us there will be more demand for our wares.' Though I have fared better than some collectors, and have usually received credit for my discoveries, yet it has grieved me that I had to send a large number of my most valuable collections of Permian and Cretaceous vertebrates to Munich, for lack of proper support and encouragement at home. And though the words of commendation from such a noted authority as Dr. von Zittel are very pleasant to receive, when he writes me my collections from Kansas and Texas are the best in Europe, and that they will be an everlasting memorial to my name, I am an American, and it has hurt me to see treasures that are of greater value than anything man's fingers or brains have created leave our shores forever. Now, as thirty-five years have been devoted to the advancement of historical geology with little hopes of ever receiving financial considerations for my life-work, and, judging the future by the past, many more of my fossils will cross the Atlantic, as did a fine skeleton of a Kansas mosasaur I sent the British Museum last month, I want to ask that the Carnegie Institution take measures, if it lies in their power, to stop this fearful drain on our natural resources and retain in American institutions the wonderfully preserved records of the Almighty in the rocks of America. I have little doubt but that specimens have left our country that can never be duplicated. I remember that the only fine specimen I ever found of a Cretaceous shark, about twenty-five feet long, now rests in Munich. Owing to the cartilaginous nature of the bones it is rare indeed to find the whole column preserved.

Not only should all the valuable fossils remain in our country, but the fossil hunter of the future should have better material returns for his labor than has been my lot. Professor Edward Orton once wrote me that the work of collecting was a pleasant avocation, but as yet would not do as a vocation. I have often thought he was right when I have had to struggle for means to keep at work so I could continue through life to add to the store of historical facts. This state of affairs should cease in the United States, and the Carnegie Institution could do no better with the fund left in their charge in advancing science than first to retain in American institutions the extinct fossils that make up the ancient life histories of the earth. And second to properly reimburse men who will give their lives, if necessary, to accumulate facts in paleontology, and prepare them for scientific study. I hold it as self-evident that there can be no advancement of the sci-

ence without the collections; that if they are made men will come to study and describe them. Thousands of pages of paleontological literature are worthless because paleontologists have attempted to restore animals they never saw from a few broken bones of the skeletons —a thing that is absolutely impossible. So also is it burdened with species after species described from fragments, when perfect specimens are found, many of them resolved into one. Such work is worse than labor lost. Nature makes no mistakes and a perfect specimen is of more value than many books describing poor or imperfect material.

Charles H. Sternberg.

Lawrence, Kansas,
November 6, 1902.

That the Carnegie Institution should, above all, accomplish work not being done elsewhere is the one proposition in this symposium which has not met with disagreement. The establishment of a vivarium for experimental evolution meets this requirement. It is no longer necessary to urge the value of such an institution. I shall only try to show why work in experimental evolution has been retarded and how a well-equipped and well-supported vivarium will make possible great development in this direction.

There is not lacking ability, interest or desire to do this kind or work. It is the lack of facilities which prevents effort. The resources of the agricultural experiment stations are not available, because they are restricted to economic problems. Experiments in evolution are beyond the means of the unassisted worker for the following reasons:

1. *Expense.*—A barn, a greenhouse and a large and adequately protected garden are required. Moreover, the collection of material would sometimes require the expense of traveling.

2. *Time.*—Every-day year-around attention is impossible for most college teachers, who are generally absent from time to time for lectures, meetings and vacations, and who cannot afford to employ a reliable and skilled assistant to carry on the routine work in their absence.

3. *Permanence.*—Such experiments often need to be continued through many years, some even indefinitely. This is very difficult in a university where such work would most likely be attempted, because it would be by the energy of but one man who might at any time be called to another position.

One must further consider that effort in such a vivarium must be vastly more productive than equal effort from individual investigators, for the following reasons:

1. *Division of Labor.*—Since much of the labor involved is of a routine nature which can be carried on by a skilled gardener or attendant, the results will be of greater value because experiments involving numbers can be carried out on a large scale and more problems can be undertaken.

2. *Superiority of Equipment.*—The equipment would be of the best, thus insuring more and better results. Accidents resulting from improvised or inadequate apparatus or arrangements have spoiled many experiments; witness the work upon breeding insect larvæ.

Let us hope that the Carnegie Institution will seize the opportunity of aiding in putting evolution at last on an inductive basis.

Roswell H. Johnson.

One respect in which German chemists have an important advantage over most Americans is that many of them work with the aid of private assistants. These assistants are usually thoroughly trained men who have already taken the doctor's degree. They have no duties as instructors or otherwise in connection with teaching.

In a few cases American chemists having independent means have employed men to aid them in their researches, but, with very rare exceptions, colleges or universities have not used their funds for such a purpose. If private assistants were furnished, who should work exclusively in carrying out experimental researches under the direction of some of those chemists who have already done good, independent work, large results would, undoubtedly, be obtained. It is difficult to see how in any other way so much could be accomplished toward furthering chemical research.

W. A. Noyes.

THE ONONDAGA LAKE SQUIDS.

SINCE sending my note concerning the alleged discoveries of squids in Onondaga Lake I have learned through Principal Wilson of the Putnam School at Syracuse that a third specimen is said to have been secured at a time, I should infer, before the other two were taken. This story, however, has not been traced to its starting point. Much more interesting, as apparently corroborative testimony of the existence of these creatures in Onondaga Lake, is the circumstantial relation given to me by Professor J. M. Scott, teacher of sloyd in the Syracuse Public Schools, a son of Principal W. H. Scott of the Porter School. On reading the accounts and seeing the cuts of the squids alleged to have been taken by Mr. Terry, as printed in the Syracuse *Herald*, he was reminded of a find of his own, in regard to which he writes me as follows:

"Some twelve or thirteen years ago a number of boys, of whom I was one, were fishing just to the left of the outlet and had a small scoop net for catching crabs and minnows. Another lad and myself went ashore, and in fooling around in the mud near the shore looking for crabs I saw something queer and got it in the net. We took it to an old man who claimed to be a sailor and he told us it was a squid. Not knowing it was of any value whatever, we amused ourselves with it awhile and left it in the water after having killed it. I have since thought it was a queer find." JOHN M. CLARKE.

THE FOSSIL TREE BRIDGE IN THE ARIZONA PETRIFIED FOREST.

TO THE EDITOR OF SCIENCE: I have recently learned from a friend who has visited the petrified forest in Arizona that the famous natural bridge is in danger of being washed away. It consists of a log spanning a gully about twenty feet in width and from ten to twelve feet in depth. Each end of the log is embedded in sandstone formed of the original deposit. Spring rains in recent years have widened the gully, and threaten to demolish the natural abutments. I write to call the attention of the readers of SCIENCE to the matter, hoping that some one may be in a position to influence the authorities in that section of Arizona to take some steps to preserve this remarkable tree.

HENRY F. OSBORN.
AMERICAN MUSEUM OF NATURAL HISTORY.

SHORTER ARTICLES.

MENDEL'S PRINCIPLES OF HEREDITY AND THE MATURATION OF THE GERM-CELLS.

IN view of the great interest that has been aroused of late by the revival and extension of Mendel's principles of inheritance it is remarkable that, as far as I am aware, no one has yet pointed out the clue to these principles, if it be not an explanation of them, that is given by the normal cytological phenomena of maturation; though Guyer and Juel have suggested a possible correlation between the variability or sterility of hybrids and abnormalities in the maturation-divisions, while Montgomery has recognized the essential fact in the normal cytological phenomena, though without bringing it into relation with the phenomena of heredity. Since two investigators, both students in this University, have been led in different ways to recognize this clue or explanation, I have, at their suggestion and with their approval, prepared this brief note in order to place their independent conclusions in proper relation to each other and call attention to the general interest of the subject.

Bateson, in his recent admirable little book on Mendel's principles, is led to express the surmise that the symmetrical result in the offspring of cross-bred forms 'must correspond with some symmetrical figure of distribution of gametes in the cell-divisions by which they are produced' (p. 30). It is needless to remind cytologists that the study of the maturation-mitoses, especially in the case of arthropods, has revealed a mechanism by which such a symmetrical distribution may be effected; for the germ-cells in the great majority of cases arise in groups of fours, formed by two divisions, of which one is in many cases described as differing in character from the ordi-

nary somatic mitoses in that it separates whole chromosomes by a transverse division ('reducing division' of Weismann). Wholly independently of Mendel's conclusions a considerable number of cytologists (vom Rath, Rückert, Häcker) early reached the conclusion that the chromatin-masses from which arise the 'Vierergruppen' (tetrad-chromosomes, or their equivalents) represent double or 'bivalent' chromosomes, each of which was conceived to arise by the union (synapsis), end to end, of two single chromosomes. An actual conjugation of chromosomes in synapsis was inferred by Rückert in some cases (*e. g.*, in *Pristiurus*), and more recently described in a far more detailed way in *Peripatus* and certain insects by Montgomery (1901), who reached the remarkable conclusion that 'in the synapsis stage is effected a union of paternal with maternal chromosomes, so that each bivalent chromosome would consist of one univalent paternal chromosome and one univalent maternal chromosome.' The ensuing transverse or reducing division, therefore, leads to *the separation of paternal and maternal elements and their ultimate isolation in separate germ-cells.* This conclusion rested upon evidence too incomplete to warrant its acceptance without much more extended investigation—it was, indeed, more in the nature of a surmise than a well-grounded conclusion. During the past year Mr. W. S. Sutton, working in my laboratory, has obtained more definite evidence in favor of this result, which led him several months ago to the conclusion that it probably gives the explanation of the Mendelian principle. In the great 'lubber grasshopper' *Brachystola* the chromosomes of the spermatogonia were found to be grouped in eleven pairs of different sizes, which reappeared in essentially the same relation through at least eight successive generations of these cells. In synapsis the graded pairs are converted into similarly graded bivalent chromosomes that appear to arise by a conjugation, or union at one end, of the two members of each of the earlier pairs. Cogent reason is given by Sutton for the conclusion that the chromosome-pairs consist each of a paternal and a maternal member. It is known that in fertilization chromosomes are contributed in equal numbers by the two gametes ('Van Beneden's Law'). Boveri's recent remarkable experiments on sea-urchins have proved that a definite combination of chromosomes is necessary to complete development, and strongly suggests, if they do not prove, that the individual chromosomes stand in definite relation to transmissible characters taken singly or in groups. Every nucleus, however, contains two such combinations; for the facts of parthenogenesis and merogony prove that either the paternal or the maternal group alone may suffice for complete development. It is a natural conclusion from these facts that the constant morphological differences of the chromosomes observed in the grasshopper are correlated with constant physiological differences. If such be the case it appears highly probable, though the argument can not here be presented in all its weight, that those of corresponding size, associated in pairs, are the paternal and maternal homologues (*sit venia verbo*)! Sutton has pointed out that if this be indeed the case, the union of these homologues in synapsis, and their subsequent separation, which this preliminary union involves, in the reducing (second maturation) division, leads to the members of each pair being isolated in separate germ-cells; and this gives a physical basis for the association of dominant and recessive characters in the cross-bred, and their subsequent isolation in separate germ-cells, exactly such as the Mendelian principle requires.

A similar conclusion was subsequently, but independently, reached by Mr. W. A. Cannon, of the Department of Botany, though by a different and less direct path of approach. A study of hybrid cotton-plants, which are fertile, showed the maturation-divisions to be entirely normal, in contradistinction to the sterile hybrids of *Syringa,* where Juel has shown that the maturation-divisions are abnormal in character. It thus appeared that a sifting apart of paternal and maternal elements, such as Mendel's law demonstrates to occur, cannot be explained on the hypothesis of irregularities in the maturation-divisions (as had been suggested by Guyer's earlier work

on pigeon-hybrids). Cannon therefore concluded, on this *a priori* ground, that such a separation of paternal and maternal elements must occur in the normal maturation-divisions, not only in the cross-bred, but also in the normal forms, and that in the character of these divisions must be sought the basis of the law. It is interesting that such a conclusion should have been reached by a botanist, on account of the fact that most recent botanical workers in this field have reached the result that transverse or reducing divisions do not occur in the maturation of the germ-cells in higher plants. It has, however, become clear that only the most exhaustive study of the most favorable material, particularly in the earliest stages of the maturation-divisions, can positively decide this question, and the importance of the most accurate and detailed further study of the phenomena is now manifest. The results I have indicated are already in part in press and will in due time be fully discussed by their authors. Should the study of the maturation-divisions indeed reveal the basis of the Mendelian principle we shall have another and most striking example of the intimate connection between the study of cytology and the experimental study of evolution.

EDMUND B. WILSON.

ZOOLOGICAL LABORATORY OF
COLUMBIA UNIVERSITY,
December 11, 1902.

THE ENLARGEMENT OF THE NAPLES STATION.

THE increased number of investigators who make each year the pilgrimage to Naples, as well as the development there of new departments of investigation, have made it imperative to enlarge the present buildings of the station. The plans for the new construction are finished, the money generously contributed, and the building is about to begin. The city of Naples, proud of her renowned Station, has given the ground for the new part. The new building will be placed near the end of the larger of the two present ones. The exterior of the new part is exactly like the larger, which is also the older, of the present buildings. The capacity of the working part of the Station will be doubled by this addition.

The new building will be devoted, in the main, to physiology and to physiological chemistry, for each of which there is to be a large laboratory, well equipped with the most modern appliances. In addition to these there will be a number of smaller rooms for special physiological work. A new feature will be rooms in which the water in the aquaria can be kept throughout the year at any desired temperature.

In the new building there will also be a large number of small rooms for zoological work—the old 'tables' in the big room opposite the present library will be given up, and the room itself added to the library. Thus the new plan, when carried out, will not only give more room, but also better accommodations.

With the awakening of zoological research in this country during the last twenty years there has been a steady increase in the number of those who go to Naples. The first American table, that of Williams College, was occupied during '83 and '84. Previous to that time eight Americans had occupied European tables. In '85 and '86 the University of Pennsylvania maintained a table; and then, after an interval of five years ('86 to '91) during which America was not represented, a table was supported by Major Davis, from '91 to '96.

The Smithsonian Institution has maintained a table from '93 to '02, which has been occupied by twenty-six investigators. Harvard University had a table for two years ('97–'02), and Columbia University has, through the generosity of a friend, paid, for five years ('96–'02), for half of 'The University Table.' Finally, the 'Association for Maintaining the American Women's Table' has supported a table for four years ('98–'02).

At present America maintains only three tables, 'The Smithsonian,' 'The University,' and 'The Women's Table.' These are entirely inadequate to allow all those who apply for tables to obtain them. For instance, there are five desirable candidates for 'The University Table' alone for the present year.

The total number of Americans who have occupied tables at the Naples Station, including the appointments to the end of the year, is eighty-one. If we omit the twelve names of those who occupied tables between '81 and '91, we find that sixty-nine American investigators have worked in Naples during the last eleven years. The international character of the work done in Naples is one of the greatest advantages to be derived from a sojourn at the Station. Here are to be seen the newest methods, and to be heard the latest points of view of some of the most advanced men from Germany, Italy, Russia, Austro-Hungary, Belgium, England, etc. This alone is an advantage, which we Americans, isolated as we are by distance from the older centers of investigation, can scarcely afford to forego. Let us hope, therefore, that America will not be niggardly in maintaining at least three tables as she does at present, and that in the near future their number may be added to, since even now they are inadequate to fill the demand.

Our national representation at the Naples Station can not be better shown than by an examination of the names of those American zoologists, botanists and physiologists who have worked in Naples. T. H. Morgan.

NOTES ON INORGANIC CHEMISTRY.

THE TELLURIC DISTRIBUTION OF THE ELEMENTS.

A paper on the above subject was read by William Ackroyd at the Belfast meeting of the British Association, in demonstration of the thesis that the telluric distribution of the elements is inversely in proportion to their atomic weights. The question of the relative quantity of the elements in that portion of the earth which is known to us is quite fully dealt with by Professor Frank W. Clarke in *Bulletin* 148 of the U. S. Geological Survey. Here the abundance of the elements is determined from large groups of analyses of rocks and other telluric products, but only twenty-one elements are considered. Ackroyd has adopted the commercial idea of price as a measure of plenty or rarity, a procedure which would seem to be of rather doubtful expediency. In some cases the price of the element itself is used; in other cases, especially where there is difficulty in obtaining the elementary form, some compound is considered. The latter is the case, for example, in the calcium group where the carbonates are used, and in the arsenic group where the basis is the oxid. Measured in this way, it appears generally that in each group the abundance of each element as measured by its commercial price is inversely proportional to its atomic weight. There are, however, a number of exceptions, where the element of highest atomic weight is more abundant than its immediate predecessor, as with barium, which appears to be more abundant than strontium; the same is true of mercury, lead, thallium, osmium, platinum, iridium and thorium. The halogens obey the general proposition, but their abundance is measured by their relative quantity in sea water. The conclusion is drawn that in the formation of the atoms from primordial matter less and less atoms of highest atomic mass were evolved, and that the universe became pervaded by the greatest quantity of those atoms which have the lowest masses. It is, in general, true that the most abundant elements are those of relatively low atomic weight, but Ackroyd's line of reasoning presents too many exceptions to bear out his conclusions.

THE NATURE OF ALLOYS.

The final report of the Committee of the British Association on this subject was presented at the Belfast meeting. The committee consisted of Messrs. Neville, Heycock and Griffiths, and the report covers a complete study of the copper-tin alloys. At least three solid solutions are formed during the solidification of these alloys. If the alloys have been cooled with sufficient slowness, the following conditions exist at ordinary temperature:

0 to 9 per cent. tin.—A uniform solid solution of copper containing tin, or, more probably, containing a compound in solution.

9 per cent. to 25.5 per cent. tin.—A complex of large crystals of the above solid solution in a minute eutectic of the same solid solution and Cu_4Sn.

25.5 per cent. to 32 per cent. tin.—The same complex, but containing the Cu_4Sn in the larger crystals, and the above solid solution only in the minute eutectic. At 32 per cent. the alloy is pure Cu_4Sn.

32 per cent. to 38.5 per cent. tin.—A complex of Cu_4Sn and Cu_3Sn, or of two solid solutions of these substances. At 38.5 per cent. the alloy is pure Cu_3Sn.

38.5 per cent. to 93 per cent. tin.—Large crystalline plates of Cu_3Sn coated with a body that is almost pure CuSn, the whole being immersed in a eutectic of this body and tin.

93 per cent. to 99 per cent tin.—Large crystals of CuSn in a eutectic of this body and tin.

99 per cent. to 100 per cent. tin.—Large crystals of tin in the same eutectic.

The whole research presents one of the completest and most valuable studies of alloys which has yet appeared, and throws much light upon the nature of alloys in general.

THE TRAINING OF TECHNICAL CHEMISTS IN ENGLAND.

ANOTHER interesting report presented to the same meeting was that of a committee, headed by Professor W. H. Perkin, on statistics concerning the training of chemists employed in English chemical industries. Information was received from 502 managers and chemists employed in English chemical industries, and while of course not every chemist so engaged is included it is believed that the list is tolerably complete. Of this number 107, or 21 per cent., are graduates of a university, while 395 have not taken a degree; 111 are fellows or associates of the Institute of Chemistry. It is perhaps worth while to present the following more detailed information from the report:

Number of graduates of a British university.	59
Number of graduates of both a British and a foreign university	16
Number of graduates of a foreign university..	*32
	107
Number of non-graduates trained in a British university or university college.....	†137
Number of non-graduates trained in a British technical college	165
Number of non-graduates trained in a foreign university or technical college.....	8
Number of non-graduates trained in evening classes, analysts' laboratories, or otherwise	85
	395

* 13 of whom studied also in a British university or technical college.

† 20 of whom studied also in a foreign university or technical college.

These statistics present a certain amount of encouragement in that over 80 per cent. of those reported have had at least some training in university or technical college, but the proportion of graduates is deplorably low. It is also probable that most of those who have escaped enumeration have had little or no university training. On the other hand, the work of the technical colleges is clearly apparent, and this is a hopeful sign for the future. The number who have received training in a foreign institution is surprisingly low, only 76 in all. It is probable that the proportion in this country would run higher, and this in spite of the greater difficulties connected with an American's studying abroad. J. L. H.

CURRENT NOTES ON PHYSIOGRAPHY.

NORTHEAST LABRADOR.

DALY'S report on 'The Geology of the Northeast Coast of Labrador' (*Bull. Mus. Comp. Zool.*, Harvard College, XXXVIII., 1902, pp. 205–270, 10 pl., 3 maps) gives the results of a Brown-Harvard expedition in a forty-ton schooner, sailing from St. John's, Newfoundland, June 25, and returning there October 3, 1900. The Torngat mountains, rising to altitudes of 5,000 or 6,000 feet, the highest summits on the Atlantic coast from Hudson strait to Cape Horn, present many sharp ridges and peaks, unmapped and unnamed; their upper slopes are cloaked with coarse rocky detritus; their lower slopes show numerous signs of strong glaciation. The fiords by which the bold coast is so greatly indented are associated with all the features characteristic of strong glacial erosion; overdeepened floors and over-steepened walls, with hanging lateral valleys and cirques in adjoining uplands. A cascading stream descended 750 feet from one of the hanging valleys into

a fiord 500 feet deep, thus making a discordance of 1,250 feet between trunk and branch ice-channels. Although the coast exhibits a very large proportion of bare rock, moraines of well-preserved form are found here and there. The limit of post-glacial sea-action is about 575 feet above present sea-level at St. John's and declines northwestward somewhat irregularly to 250 feet at the furthest point reached. Within the wave-washed slope boulders are rare; sea-cut and sea-built shore lines are common.

A narrative of the expedition is given by Delabarre (*Bull. Geogr. Soc. Phila.*, III., 1902, 65–212).

PHYSICAL GEOGRAPHY OF NEW YORK.

THE series of articles contributed by Tarr to the *Bulletin of the American Geographical Society* is now published in book form—'The Physical Geography of New York State'—with a chapter on Climate by Turner (Macmillan, 1902, 397 pp., many figures and maps). It makes by far the most compendious treatise yet devoted to the physiography of the Empire State, and must prove of great service to students there and elsewhere from its interesting style, its abundance of illustration (some of the half-tone cuts are, however, blurred to the point of being useless defacements of the pages), and its plentiful reference to sources. Yet the book is disappointing, in so far as it shows that regional physiography is still an undeveloped subject, uncertain of its limits, relatively unsystematized and undisciplinary in its methods, and not clearly guided in its presentation by a thoroughly developed scheme of systematic geography. To Tarr, nevertheless, belongs the merit of actually accomplishing an important piece of work according to his best plan available for it, while other physiographers seem to hesitate to begin such tasks because they do not see clearly through them to the end.

NEW MAP OF SWITZERLAND.

THE Federal Topographical Bureau at Bern has recently published a four-sheet wall map of Switzerland on a scale of 1:200,000, in which the illusion of actual relief is most effectively produced. The original map was colored by Künemerly, artist-lithographer of Bern. It subdues the lowlands in a cool gray tint, and brings out the mountains as if lighted from the northwest by a mid-summer sunset; the illuminated slopes being white or rose, the shaded slopes blue or purple. The area includes reaches from the southern Vosges and Schwarzwald to the northern border of the plains of Lombardy, and takes in the whole of the Jura on the west and part of the Tyrolese Alps on the east. Boundaries and the larger towns and cities are in red, water in blue, roads and names in black. Contours are drawn for every one hundred meters. The map is an exceptionally fine piece of work and should come into general use in the study of the Swiss Alps.

W. M. DAVIS.

SCIENTIFIC NOTES AND NEWS.

THE committee of the House on Buildings and Grounds has reported favorably the bill, which has passed the Senate, carrying $2,500,000 for the construction of a new building for the Department of Agriculture, but reduced the limit of cost to $1,500,000.

DR. W. A. SETCHELL, professor of botany at the University of California, has been given leave of absence for the next academic year.

MRS. M. C. STEVENSON has returned to Washington from ethnological investigations at Zuñi.

AT New York University Professor Carl C. Thomas, head of the department of marine engineering, has resigned to devote his time exclusively to professional work on the Pacific Coast.

DR. ROSE BRADFORD has resigned the post, which he has held since 1896, of professor-superintendent of the Brown Animal Sanitary Institution, London.

MESSRS. SIEMENS and Halske, Berlin, have acquired the European patents of the system of long distance telegraphy, discovered by Professor Michel Pupin, of Columbia University.

DR. ANDREW BALFOUR, of Edinburgh, is going out as director of the chemical and phys-

iological laboratories at the Gordon Memorial College, Khartoum. These laboratories are equipped with the most modern appliances, and are the gift of Mr. H. S. Welcome, who recently visited the Soudan.

MR. JONATHAN HUTCHINSON, F.R.S., is about to start for a tour in Ceylon and India, hoping to confirm his hypothesis that the consumption of badly-cured fish is the cause of leprosy.

THE death is announced of Mrs. Alice Freeman Palmer, formerly president of Wellesley College. After her marriage to Professor Palmer, of Harvard University, she continued to take an active interest in educational matters.

MR. LUDWIG KUMLIEN, who was naturalist of the Howgate Polar expedition in 1877, and was afterward connected with the Smithsonian Institution and the Fish Commission, has died at his home in Milton, Wisconsin.

THE directors of the Ben Nevis observatories have obtained funds to keep the observatories open until October, 1904.

THE New York *Evening Post* states that an important meeting of the New York State Electrical Laboratory Commission was held in New York on Monday, December 8. There were present State Engineer Bond; Harold W. Buck, of Niagara Falls; C. P. Steinmetz, of New York city, and State Architect Hines. Plans already submitted to the commission were approved, and Messrs. Buck and Steinmetz reported on the amount of space needed for the electrical apparatus. The cost of the proposed buildings and equipment will be between $250,000 and $300,000. The buildings alone will cost in the neighborhood of $100,000. The commission decided to make a preliminary draft of its report to be presented to the legislature at the next session of that body.

THE Carnegie Institution has made a grant of $500 to Professor Bancroft, of Cornell University, for a systematic study of the bronzes. The work will be similar to that recently published on the alloys of bismuth, lead and tin, and will consist primarily in the analytical determination of the solid phases.

THE medical papers report that the Carnegie Institution has made an annual grant of $10,000 to revive the *Index Medicus,* formerly published under the direction of Dr. John S. Billings. The New York *Evening Post* states that the institution has made a grant of $1,000 to the astronomical department of Vassar College to enable Dr. Caroline E. Furness to make measurements and reductions of photographs of the stars in the region of the North Pole.

A BILL has been passed by the House of Representatives for the incorporation of a 'general educational board' the incorporators named in the act being the following well-known educators: Daniel C. Gilman, George Foster Peabody, Morris K. Jesup, Robert C. Ogden, William H. Baldwin, Jr., Jabez L. M. Curry, Frederick T. Gates, Walter Page and Albert Shaw. This is a movement for advancing education in the south, in which Mr. John D. Rockefeller and others have taken an interest. The scope of the board is, however, very broad, being described as follows: "To build, improve, enlarge, or equip buildings for elementary or primary, industrial, technical, normal or training schools for teachers, or schools of any grade, or for higher institutions of learning, or, in connection therewith, libraries, workshops, gardens, kitchens, or other educational accessories; to establish, maintain, or endow such schools; to employ or aid others to employ teachers and lecturers; to aid, cooperate with or endow associations or other corporations engaged in educational work within the United States; to collect educational statistics and information and to publish and distribute documents and reports containing the same."

IT is stated in the London *Times* that the royal commission on arsenical poisoning has recently held a series of meetings in connection with a report received from their Assistant Commissioner, Mr. H. Hammond Smith, on the liability of articles of food and drink other than beer to contain arsenic, and have taken evidence from certain manufacturers on this part of their reference. Several chemical and other inquiries which the

commission have instituted are also in progress. It is understood that the commission will complete taking evidence early in the next parliamentary session, and will then prepare their final report.

On December 6, at the Randal Morgan Physical Laboratory of the University of Pennsylvania, a physical club was organized under the name of the Kelvin Physical Club for the encouragement of research and scientific reviews in the department. Professor Arthur W. Goodspeed was elected president, Dr. Horace C. Richards, vice-president and Dr. Joseph H. Hart, secretary.

The American Society of Mechanical Engineers held its forty-sixth meeting in New York City, December 2 to 5.

At a meeting of the Royal Society of Edinburgh on December 1, Lord Kelvin presiding, Professor J. Cossar Ewart read a paper on a new horse from the Western Islands. According to the report in the London *Times* he said that until quite recently it was quite commonly assumed that all living horses belonged to one and the same species. It had also been generally assumed that various breeds of European horses had been descended from domestic varieties originally from the East. Since numerous etchings had been discovered on the walls of caves the belief was no longer so universal that the horse had not been domesticated in Europe before the arrival of Neolithic man. After pointing out the difference between horses and zebras and donkeys in that zebras and donkeys had no callosities, Professor Ewart proceeded to describe the Przevalsky horse, and next the new variety which had recently been discovered. This was a pony, not the dwarf horse that took the place in the West which the Arab took in the East with similar characteristics to the Arab, but having this essential difference, that there were no callosities in the hind legs, and instead of having long hairs right up to the root of the tail, it resembled the wild horse of Central Asia, the Przevalsky horse, in having short hairs in the upper part of the tail just as in mules. As the most typical specimen had been found in an out of the way part of Iceland there was no chance of its ever having been crossed with a Przevalsky horse; it was exactly of the same color as the wild horse of Central Asia. Not having callosities, it agreed with the asses and zebras, and, like the asses and zebras, it was highly specialized in the size, form of the head, ears, and under lip, and the position of the eyes. The Celtic pony decidedly differed from the Przevalsky horse. The limbs were slender with small joints and narrow hoofs. The Celtic pony occurred in Iceland, the Faroë Islands, and Barra, and other smaller islands of the Outer Hebrides. It at one time seemed to have been common in the island of Tiree, in which ponies were now extinct. Doubtless it occurred in Ireland, a very typical example having recently been found in Connemara. There was evidence also that it occurred in the New Forest. On the other hand, there was no evidence that ponies of this kind were found anywhere in the East. Java, Mongolia, Korea and Kathiawar had all been examined, but all the ponies there had had the characteristics of the Arab horse. They had all callosities, well haired-up tails, and long pointed ears. It was conceivable that the Celtic pony in its present form never existed in the East, but that it was the modified descendant of a small horse which left the ancestral home in Central Asia and reached Europe long before the arrival of Neolithic man. There were drawings in caves which suggested the existence of a small horse that might very well correspond to the Celtic pony, and further, bones had been found of two kinds of horses, one a horse with small head, slender limbs, and small teeth, which, again, suggested the Celtic pony.

At the Society of Arts, London, on November 26, Dr. Gustave Goegg, professor of technology at the High School of Commerce, Geneva, read a paper on the Simplon Tunnel. According to the report in the London *Times*, he observed that the pass over the Simplon had been for centuries one of the routes from the valley of the Rhone to Lombardy, and after various schemes had been brought forward, the Jura-Simplon Company, who had

obtained a concession for making the line, agreed with a syndicate for its construction. There were to be two tunnels side by side. It was agreed that the work should begin at latest on November 13, 1898, and the first tunnel was to be completed, and the piercing of the second tunnel finished, in five years and a half—by May 15, 1904. The length of the tunnel was 19,770 meters. At the beginning hand-drilling gave a progress of 1.94 meters a day, but since hydraulic drills were set to work the progress made had been at the rate of seven, eight, and ten meters daily. Up to the end of last month 13,608 meters had been pierced. Owing to difficulites, the syndicate had requested that the date for the termination of the work might be extended for fourteen months—to July 1, 1905. There existed a desire for the construction of a French railway which might utilize the Simplon Tunnel, and repair the injury which the St. Gothard Tunnel had inflicted on French commerce. M. Bénassy-Philippe, president of the French Chamber of Commerce at Geneva, had taken the lead in the promotion of such a line, about 75 kilometers long, connecting Lons-le-Saulnier-Sainte Claude and Geneva, and crossing the Jura in the district known as La Faucille, thus saving three hours in the journey between Paris and Geneva and two hours on the St. Gothard line. The proposal for constructing such a railway met with great sympathy in Italy, as it was felt that such a line was just what was wanted to ensure the passage of much of the traffic to the east through the new tunnel. English commerce would flow through whichever tunnel was served by the shortest route, and this would eventually be by the La Faucille line and the Simplon Tunnel.

IN view of the great works for irrigation now being planned by the Geological Survey, the review of irrigation works for India recently published by the British government is of interest. According to the London *Times* the 'productive works'—that is, those constructed out of loan funds in the expectation that they would prove directly remunerative—yielded a net revenue of about £1,633,000, the largest on record, equivalent to a percentage of 7.36 on a total capital outlay of £22,172,000. This percentage has only once been exceeded—viz., in 1897–98, when it was 7.50. The most profitable results were obtained in the Punjab and Madras, where the percentages were 11.24 and 9.05 respectively. Out of 35 works classed as productive, 13 (including all the canals in Bengal, the Deccan and Gujarat) are never expected to cover the interest on the capital outlay. The 22 actually productive works yielded 10.11 per cent. One canal, the Cauvery delta in Madras, returned 34.81 per cent. If the total surplus profits realized up to the end of 1900–1901 be added together, the open canals have produced 27½ per cent., after paying all charges for interest and working expenses. No new productive works were opened in 1900–1901, but £612,000 was spent on seven new works in Upper Burma, the Punjab, and Sind. With regard to works constructed out of the famine grant as 'famine protective works' not expected to be remunerative, it is noteworthy that they yielded a return of 2.35 per cent. on capital. But this is largely due to the great and increasing success of the Swat River Canal, which alone yielded 10.41 per cent. Five more protective works are under construction. There is a large number of 'minor works,' which irrigated 2,625,456 acres in 1900–1901, and returned 7½ per cent. on capital. Those in Sind proved the most lucrative, yielding 26.18 per cent. Another class of 'minor works,' for which no capital accounts are kept because they were mostly constructed under native rule, irrigated 2,581,829 acres. Moreover, Madras Presidency has 28,000 tanks and 6,000 irrigation channels, irrigating 3,173,250 acres. The total area irrigated by all descriptions of works in 1900–1901 was 19,646,000 acres, the largest on record. The total capital outlay on works for which capital accounts are kept has been about £28,320,000, yielding in 1900–1901 about 6¾ per cent., after payment of interest, etc. The value of the crops raised on the irrigated area during the year was estimated at £27,667,000, or approximately the amount of the capital outlay. On

the whole irrigation has been profitable not only to the cultivator, but also to the general taxpayer, for up to the end of 1900–1901 the total gain to the State amounted to £11,250,000. The gain would have been much greater but for the expenditure in earlier days on some of the works expected to be remunerative.

The Paris Academy of Medicine dedicated on November 25 the new building provided for it by the government. The president of the republic was present and speeches were made by Dr. Riche, president of the academy; M. Chaumié, minister of education, and Dr. Jacoud.

UNIVERSITY AND EDUCATIONAL NEWS.

We noted recently that the University of California will begin at once the construction of a special laboratory of physiology for Dr. Jacques Loeb. It is now announced that the $425,000 lately given to the University will be used for the construction of a Hall of Physiology to be completely equipped with research laboratories, salt water aquaria, etc. Professor Loeb will begin his work at the University of California in January.

By the will of Benjamin Barge of Mauch Chunk, a bequest of $80,000 is made to Yale University, $75,000 of which is to establish a chair in the romance languages and literature. Lafayette College receives $2,500.

Mr. Morris K. Jesup, president of the American Museum of Natural History, has given $10,000 to Princeton University to be added to the fund that he has established for the benefit of the library.

Mr. William S. Hubbard, of Indianapolis, has promised to give the last $5,000 needed to purchase the United States Arsenal grounds in that city as a site for the National Technical Institute.

The library building, given to Trinity College, Durham, N. C., by Mr. James B. Duke, will be opened in January. The dormitory given by Mr. B. N. Duke, is already occupied. It will be remembered that last spring Mr. B. N. Duke established four new chairs at Trinity College, including a chair in applied mathematics, to which Mr. L. C. Nicholson has now been called.

The new buildings of Wooster University erected at a cost of over $400,000, were dedicated on December 11. It will be remembered that the buildings of the university were almost completely destroyed by fire about a year ago. The chief contributors to the new university buildings are Andrew Carnegie, $100,000; Louis H. Severance, Cleveland, $75,000, and H. C. Frick, Pittsburgh, $35,000.

In his last report, President Wheeler, of the University of California, stated that among the most urgent needs of the university were buildings for botany, physics and physiology.

Mr. G. W. Palmer, M.P., has given $1,000 towards the physiological laboratory of the University of London.

The delegates in attendance at the conference of the Association of American Universities to be held at Columbia University during convocation week will be entertained at a dinner on the evening of December 30. Alumni of the fourteen universities represented in the association are invited to subscribe to the dinner, the cost of which will be $5.00. Application for tickets may be made to the chairman of the committee, Professor D. B. Woodward, Columbia University.

At a recent meeting of the corporation of the Massachusetts Institute of Technology Mr. Elihu Thomson, of Lynn, was elected non-resident professor of applied electricity and Mr. Percival Lowell, director of the Lowell Observatory at Flagstaff, Ariz., non-resident professor of astronomy.

At McGill University, Dr. A. H. Gordon has been appointed demonstrator and Dr. H. W. Thomas fellow in pathology.

Professor Knight has resigned from the chair of moral philosophy at the University of St. Andrews, after having discharged the duties of the office for twenty-seven years.

Dr. W. A. Tilden, professor of chemistry in the University of London, has been elected dean of the faculty of science in the University of London.